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Sturm and Dillard Co., Circleville, Ohio, Gravel Plant

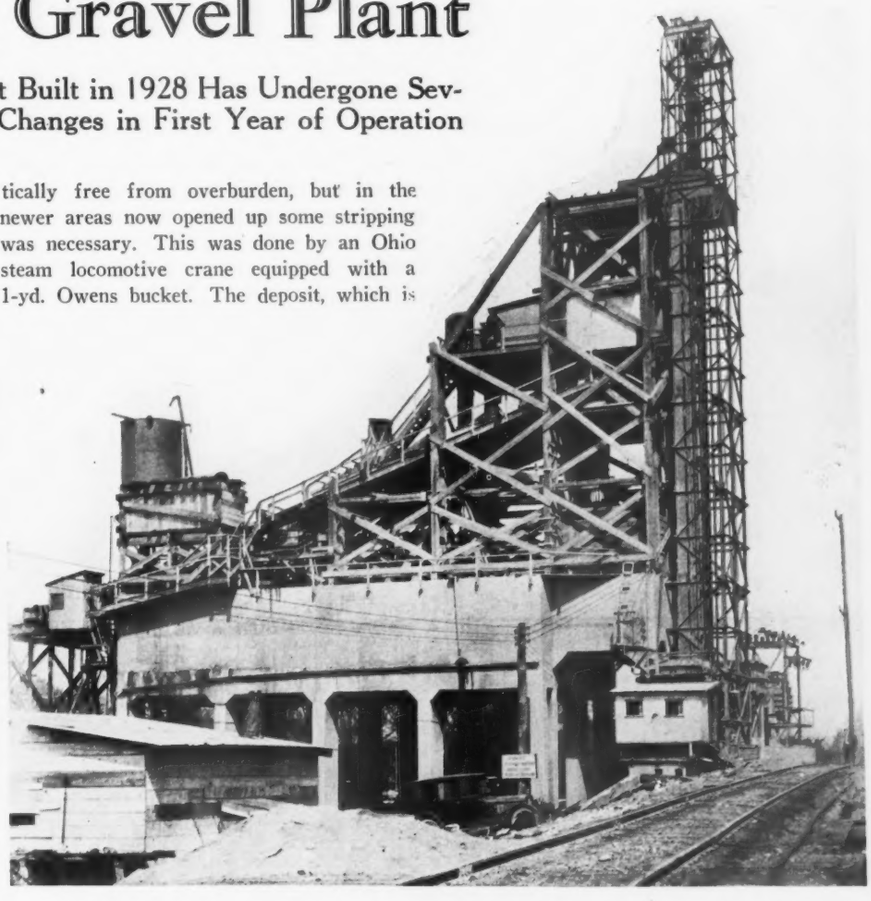
A Modern Plant Built in 1928 Has Undergone Several Important Changes in First Year of Operation

CONSTRUCTION of the sand and gravel washing plant of the Sturm and Dillard Co. was started early in 1928 and operations began later that year. The plant, which has a capacity of 3000 tons per day, was designed with certain features that were later either augmented with additional equipment or replaced so as to produce a cleaner gravel and a better grade of sand as well. These changes, which will be referred to in more detail, reduced the amount of silt from 3.0% down to 0.8%, according to J. H. Adams, superintendent. The changes also improved the quality of the sand so that the company can ship into the Columbus, Ohio, territory and successfully compete with Canadian sand which had been used mostly for mason work in Columbus. The changes not only produced a better grade of material but increased the plant's output. Circleville is 25 miles south of Columbus.

Changes Enhance Operation Efficiency

In the December 22, 1928, issue of ROCK PRODUCTS, reference was made to this operation, as one of our editors visited the operation about that time, but the descriptive article was not published, as we wished to wait for information on the plant after it had operated a while and had its kinks ironed out. Very often a new plant may be considered a top-notcher, but when operations begin many times major changes have to be made, and a description of the operation before the changes are made may be misleading. This particular plant was no exception to the above condition, although the changes made are not to be considered as radical or involving any rebuilding, but simply additions based on experience in operation that would give a better product.

The company controls several hundred acres of gravel-bearing ground that is practically free from overburden, but in the newer areas now opened up some stripping was necessary. This was done by an Ohio steam locomotive crane equipped with a 1-yd. Owens bucket. The deposit, which is



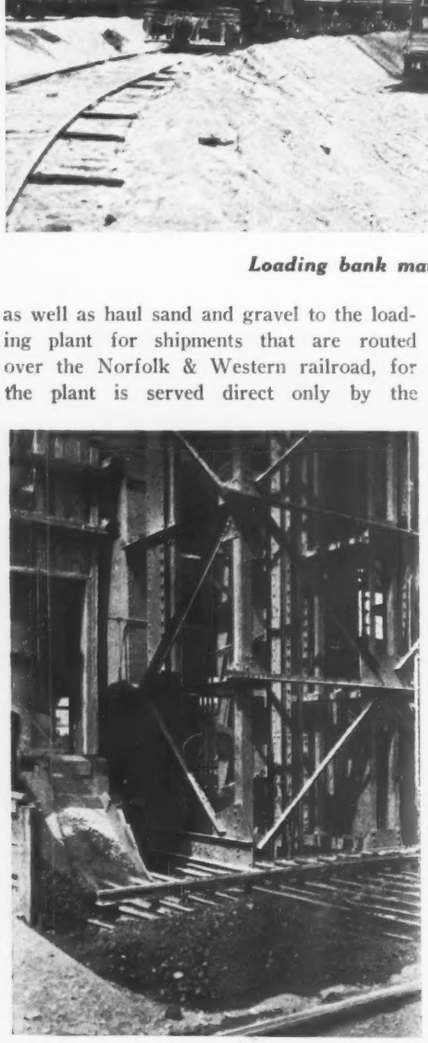
General view of the Circleville, Ohio, plant, Sturm and Dillard Co.

three miles north of Circleville, Ohio, has a length of 1¼ miles and extends to a considerable depth. The present workings have developed a face 25 to 35 ft. high, and the material will average 66% gravel and 34% sand. The sand as it appears in the bank has very little foreign matter in it, and in many localities a simple washing would suffice, but this company has made an enviable reputation for itself by making a good product better. The gravel is not large and, roughly, 25% of the total gravel is recrushed in the two gyratories at the plant; 15% crushed by the 10-in crusher and 10% by the 6-in. The former is set to discharge 1½-in. material and the latter 1-in.

The material is loaded into 20-yd. Western side-dump cars by a Marion 60 steam shovel, standard railroad mounted, and equipped with a 2½-yd. bucket. The company has five of these cars in service. The cars are hauled to the plant over standard-gage rails by an American 50-ton steam locomotive or a Porter 55-ton. These two locomotives also do all the necessary switching and spotting of cars at the loading bins

Loading bank material at the pit

as well as haul sand and gravel to the loading plant for shipments that are routed over the Norfolk & Western railroad, for the plant is served direct only by the Chesapeake & Ohio railroad. When it is desired to ship over the former system, the material is hauled, in the same type of cars that are used in the pit, to a track hopper, served by a 24-in. belt conveyor, where the washed sand and gravel is dumped. The belt conveyor then elevates and conveys the material over the main-line tracks of the Chesapeake & Ohio railroad to a set of four bins, under which is the switch that connects with the main line of the Norfolk & Western, that parallels the Chesapeake & Ohio tracks approximately one mile away. This arrangement permits shipment on foreign rails without the necessity of paying switching charges, and makes it possible for the company to reach a wider market. The belt used on this conveyor was supplied by the B. F. Goodrich Rubber Co., and is driven by a 40-hp. General Electric motor, 865 r.p.m., through a Link-Belt silent chain drive.



Discharge of the 6-in. crusher goes to a grizzly over the skip loading pocket

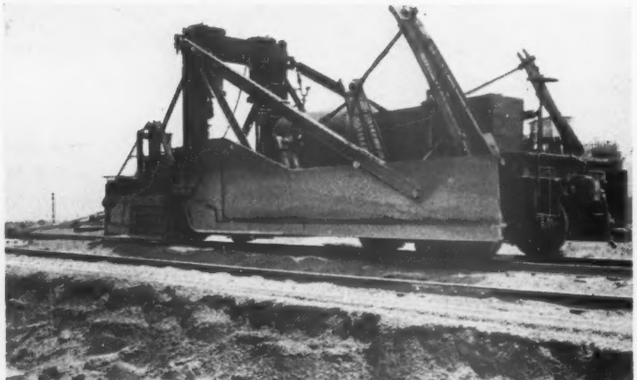
Special Reloading Plant

The re-loading plant is approximately three-quarters of a mile east of the main plant, and is connected therewith by company-owned standard-gage tracks. Near the track at the end nearest the re-loading plant, the company has built up a storage pile of mason and concrete sands, these products being dumped alongside the track and from spur tracks leading from this line, and when the material has accumulated to a depth that prevents further dumping, the steam locomotive hooks on to a Jordan ballast spreader which levels off the piles. This rather unusual addition to a sand and gravel operation levels off and distributes the sand, and a swath 14 to 16 ft. wide can be made before it is necessary to move the track.

Automatic Balanced Skip Hoist

The cars on arriving at the washing plant are air-dumped to a rail grizzly, spaced at 8 in., to a track hopper serving the balanced skips. These are two Link-Belt, 6-

One of the 6-ton skips dumping to the bin ahead of the scalping screen

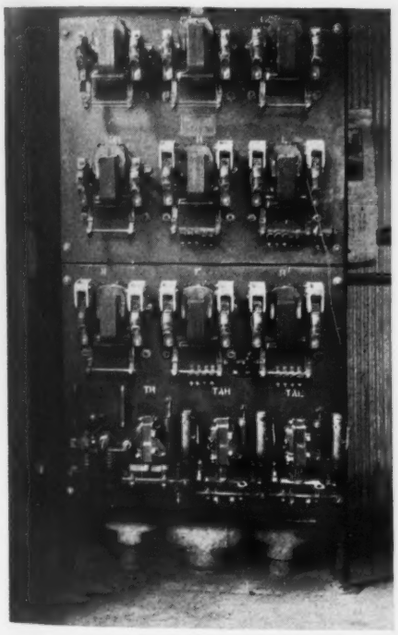


Railroad ballast scraper used to level off stock piles of sand alongside the car loading tracks

The wide swath cut by the scraper eliminates track shifting at the storage piles

ton capacity, steel skips which are automatically filled from this hopper, the loading gate being opened by the skip as it descends under the pocket. The skip is allowed to remain in the loading position for a definite and predetermined time, which is calculated to be sufficient to allow the skip to fill completely, after which the gate automatically closes and the hoist mechanism starts elevating the skip, first at a slight inclination so as to get the skip from under the pocket, after which the load is hoisted vertically to the top of the plant and dumped.

All the skip operations are automatic and each operation is set according to time, a certain number of seconds being allowed for filling, for elevating from under the skip loading pocket, and for traveling the main lift. If the skip is loaded before the time prescribed has elapsed, there is no danger of the gravel spilling, as the installation is so designed that the back-up effect of the material in the filled skip and that from the open gate prevents further flow of material. The skip, as it emerges from under the loading pocket, is elevated

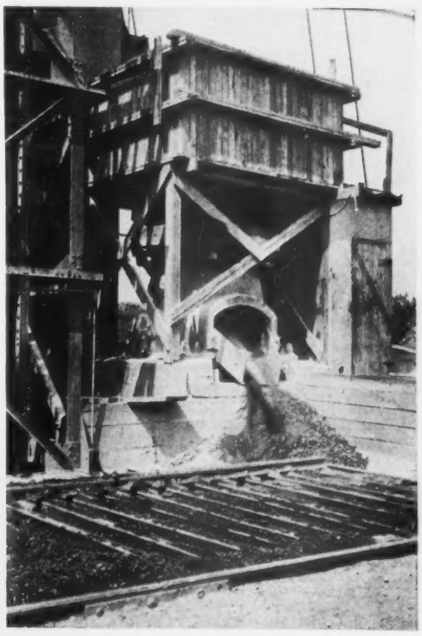


Control panel for the balanced skip system

at 156 ft. per minute, but on approach to discharge is automatically slowed down to 78 ft. per minute. The single-drum of the Link-Belt hoist is wound with 24 turns of 1-in. cable, with the two free ends of the cable passing over suitable sheaves and fastened to the two skips.

The skips, with control mechanism, hoisting engine and supporting guards, were all supplied by the Link-Belt Co., and the electric control panels are Cutler-Hammer equipment. The hoisting engine is a Type R-3, 48-in.-dia., single-grooved drum, designed for an unbalanced pull of 12,000 lb. The engine is connected through a Link-Belt, silent-chain drive to a 125-hp. Lincoln "Line Weld" electric motor, Frame HR, which operates at 1200 r.p.m. at no load and 600 r.p.m. at full load. A solenoid brake, Type CR-9510-416-68, controls that feature of the hoisting engine.

The steel skip guides from the floor of the loading pit to the center of the 42-in.-

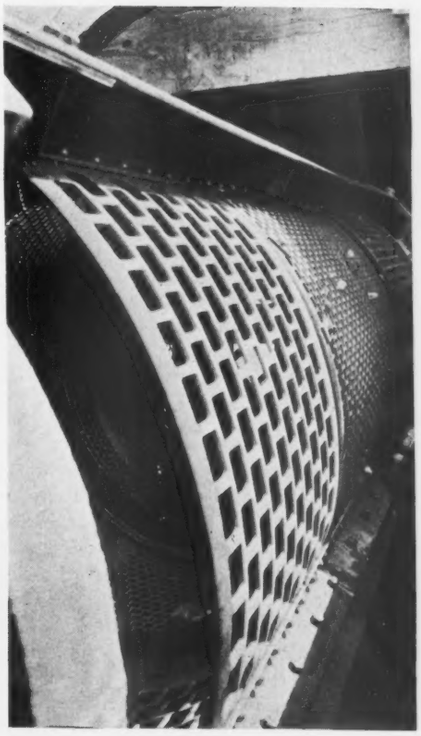


Oversize is crushed by a 10-in. gyratory which discharges to the track hopper

dia. top sheave are 137 ft. 10 in. high, of which 26 ft. 9 in. is below the plant's ground line level, and the upper 25 ft. is for the room required incidental to the dumping operation.

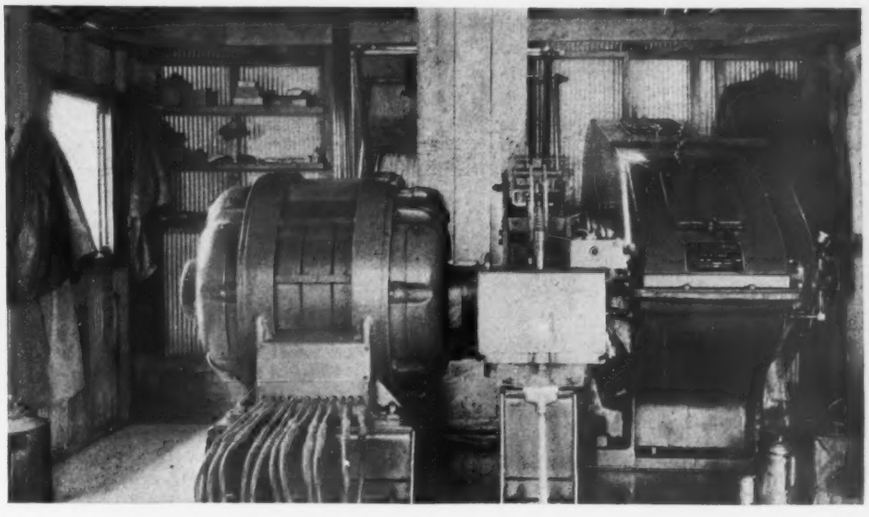
Initial Screening

The skips discharge to a small hopper-bottomed bin serving the single 72-in. by



The 72-in. by 20-ft. scalping screen makes four separations

20-ft. scalping or primary screen, the first 8 ft. of which has 2-in. round perforations; the second section is also 8 ft. long, but has 1½-in. square perforations, and the 4-ft. end section has 4-in. square openings. The material is fed by gravity through an inclined chute to this screen, where it meets a flow of water from a 10-in. pipe. This pipe extends into the drum, roughly, 4 ft., and has on its end a reducer "T," one end of the "T" pointing downward toward the banked gravel and presenting an 8-in. opening, and through this opening a large volume of water flows constantly. Joining the reduced opening of the "T" is a short sec-



Motor and drive and automatic controls for the balanced skips

tion of 4-in. perforated pipe which serves to deliver water to the middle section of the screen. The plant uses, roughly, 2,500,000 gal. of water per 10-hour day, and about 80% of it is delivered into the system at this point.

In addition to the large volume of water supplied at the scalper or primary screen, each of the conical screens and the Simplicity vibrating screens, which will be described later, is supplied with fresh water.

The scalper is driven by a 20-hp. General Electric motor, 855 r.p.m., through a Link-Belt silent chain drive.

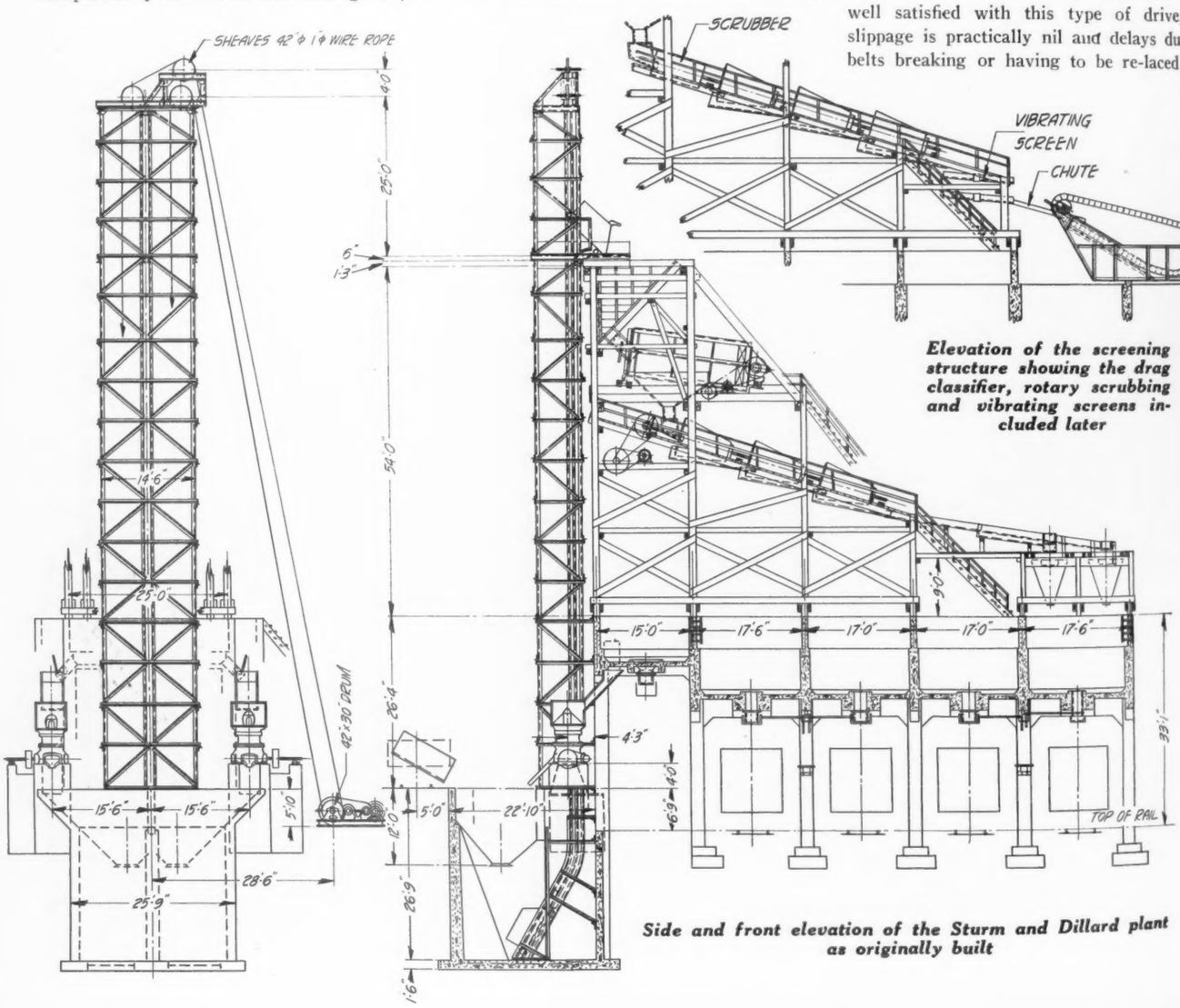
Crushing

The minus 4-in. product from the end section of the screen is chuted to a bin which serves a 6-in. Allis-Chalmers McCully gyratory crusher, or if desirable the material in this bin can be loaded for shipment through suitable gates below to trucks but not to railroad cars. Similarly, the oversize from the end of the rotary screen is chuted to a 10-in. McCully gyratory crusher. The amount of these two oversize products is comparatively small and will average 10% for the minus 4-in. size, and 15% for the larger or plus 4-in. product.

Drag classifiers were added to permit a wider grading of sands

The 6-in. McCully crusher is driven through a 9-strand "Texrope" drive by a 50-hp. Allis-Chalmers induction motor using 440-volt, 3-phase, 60-cycle current, purchased from a local power company. The 10-in. gyratory is driven by a 100-hp. motor of the same make, using a similar but heavier type drive. The operators are very well satisfied with this type of drive, as slippage is practically nil and delays due to belts breaking or having to be re-laced are

Elevation of the screening structure showing the drag classifier, rotary scrubbing and vibrating screens included later



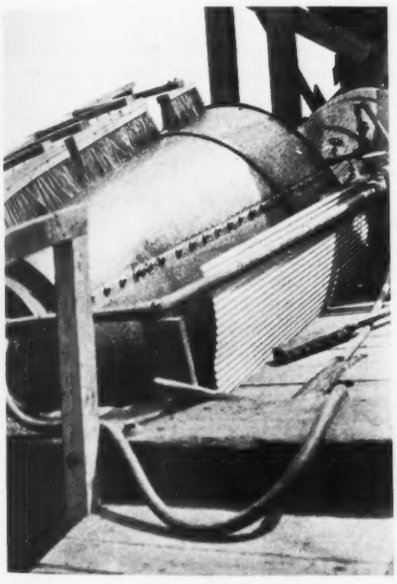
Side and front elevation of the Sturm and Dillard plant as originally built

unknown, as the drive is designed heavy enough to easily carry the load should one strand break, and any repairs then needed could be done at a later time so as not to jeopardize the production program.

Washing and Screening

The minus 2-in. and minus 1½-in. material join and flow to a 48-in. by 10-ft. cylindrical rotary scrubber where the gravel is thoroughly scoured before passage to the three conical Dull screens for classification. This scrubber simply lifts the gravel by means of projections fastened to the sides of the drum, allowing the gravel to fall through the water. There are two parallel sets of these scrubbers and conical screens. The installation of the two scrubbers was one of the features installed after the plant had operated a short time.

The first or upper conical screen has ¾-in. square perforations, the second ⅜ in. square perforations, with the end conical screen equipped with ⅛-in. by ⅝-in. slotted metal, the long axis of the slot being in the direction of rotation of the screen. Both bat-



Brushes keep the openings clear on the last conical screen in the series

teries of conical screens are identical and are driven by a 20-hp. motor from a shaft serving both sets of screens.

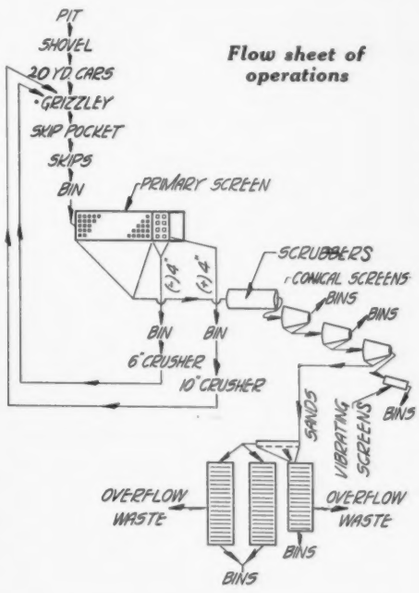
The ⅜-in. to ⅛-in. material, from the last conical screen in each battery of screens, falls to two 3-ft. by 6-ft. double-decked Simplicity vibrating screens, one screen serving each set of conical screens. The upper deck of these screens is equipped with ¼-in. square perforations, and the lower with ⅛-in. wire cloth. These screens act as cleaners for the finer sizes of gravel, removing any objectionable oversize, and give the desired sizes a final wash to remove any remaining sand.

The various sizes of gravel produced fall to bins below, and the sand flows through a launder with a $\frac{3}{16}$-in. round perforated bottom to three Jeffrey drag classifiers. The three sand drags replace a series of cone classifiers, and this equipment is one of the reasons for the reduction of silt from 3.0% to 0.8% in the washed sand.

Sand Washing and Sizing

The minus ⅛-in. material produced from the perforated launder falls to a separate sand drag, which is 23 ft. long and equipped with ninety 36-in. drags that move at 41 ft. per minute.

The plus ⅛-in. material is split and passed

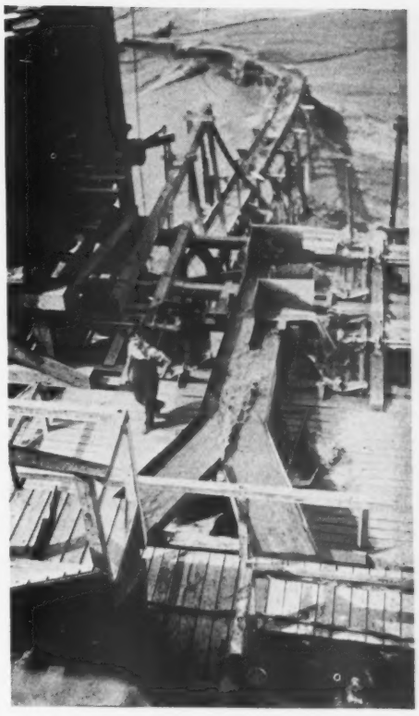


Flow sheet of operations

to two larger sand drag units operating in parallel. These classifiers are 27 ft. long and are equipped with 100, 48-in. drags that move at 47 ft. per minute. All three sand drags are driven by a 15-hp. induction motor through open gears and a series of light chain drives. The larger drag has a capacity of 48 tons per hour and the smaller 30 tons per hour. Gradually these figures are the actual as well as the rated capacities. The Simplicity screens are driven by direct-connected 5-hp. motors that are mounted on the frames of each screen.

The sand from the drag producing masons' sand, and that from the other two classifiers producing concrete sand, falls to separate bins below. Screen analysis of the two sands are as follows: Concrete sand passes a screen with ⅛-in by ½-in. slotted perforations, mason's sand passes $\frac{3}{16}$-in. round perforations.

The entire washing and screening equipment is mounted on top of the eight reinforced-concrete storage bins by means of steel and timber supports. The crushers are on the ground, one on each side of the track hopper, thus making the operation without elevators except the skips. The crushed gravel is not segregated as is the practice



Looking down on the sand washing plant

at some of the later built plants, but is returned to the system and becomes part of the gravel and sand aggregate.

The plant, through the addition of the equipment referred to, has a capacity of 3000 tons per day of 10 hours, and employs 40 men for capacity production. During the summer the volume of business was such that the plant operated on a 12-hour basis, and of the material produced practically all went into general construction. There was somewhat of a delay in resumption of capacity operation on account of the unusual

Vibrating screen serving each set of the conical screens

Pumps are placed in a special concrete structure to protect them from possible high water in the river

amount of spring and early summer rainfall in that vicinity. Most of the company's shipments are by railroad, but for local deliveries six trucks are in service, and their deliveries will account for, roughly, 10% of the total shipments, or an equivalent of 6 cars per day. Some railroad ballast is also produced.

At the time of inspection there was no gravel in the reserve storage piles, although some washed sand was on hand, but it is the company's policy to build up a reserve rather than slow down operations during any temporary lull in shipments. This material is reclaimed by the clamshell crane now used for stripping, which can load direct to trucks, cars or to a Blaw-Knox batcher. Bank-run gravel can be loaded direct to gondolas if necessary.

Water Supply

Water is secured from the Sciota River, which flows within a few hundred feet of the plant, by three direct-connected centrifugal pumps. The pumps placed in a concrete-lined pit at the bank of the river, and are protected from flood water by a reinforced-concrete superstructure so designed that flood waters cannot get into the pump room.

In the bottom of the pit are two Allis-Chalmers, 8-in. by 8-in., Type S.F. centrifugal pumps direct-connected to individual 75-hp. induction motors. The pumps operate at 1765 r.p.m. and each delivers 2500 gal. per min. against a 95-ft. head. The discharges from two pumps join by means of a "Y" in the pump's pit, and the water is delivered to the plant through an 8-in. line.

In addition there is a single, 6-in., Fairbanks-Morse, Type H, centrifugal pump direct-connected to a 30-hp. induction motor, and this pump delivers water to the plant through a separate line.

As the pump pit is approximately 25 ft. deep and has a floor section of about 12 ft. by 12 ft., with no natural means of ventilation, a small No. 1½ American Blower Co. fan is provided, which is direct-connected to a ¼-hp. Westinghouse motor, with the fan discharging through a 6-in., sheet-iron pipe to a point outside.

Personnel

The main offices of the Sturm and Dillard Co. are at 801 Huntington Bank Bldg., Columbus, Ohio. L. E. Sturm is president; John L. Dillard, vice-president and general manager, and E. W. Mulhauser is secretary and treasurer. J. H. Evans is sales manager, and J. H. Adams is superintendent.

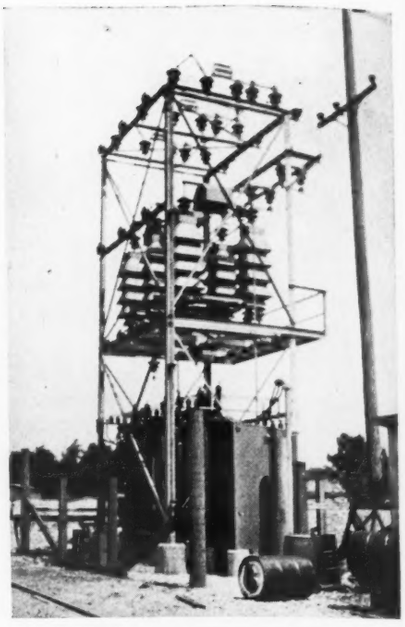
Variety of Slate Products Made by Portland Company

FINISHED slate in a variety of artistic and utile products is a feature of the Portland-Monson Slate Co., Portland, Me., operators of a large slate quarry at Monson, Me., and finishing plant at Portland. Sinks and tubs and other standard plumbing fixtures are produced and special jobs such as shower stalls and slate urinals are made to specifications. Lately another sideline has been added. This is the making of slate stepping stones and walks.

At Monson, Me., the Portland company owns and works one of the finest slate quarries in all New England. Monson slate has a national reputation for its extremely high adaptability to electrical uses. Practically the entire output of the quarry at Monson is sold to the General Electric Co. for use in switchboards and other equipment made by them.

The company recently introduced modern methods in slate mining into their workings. Instead of mining the slate in a large wide opening, shafts are sunk vertically and then horizontal tunnels are made from them.

Some of these shafts are over 750 ft. deep with the tunnels running from them to 300 ft. distances. One of the peculiarities of this slate vein is in the fact that it is very nearly perfectly vertical.



The transformer station, Sturm and Dillard plant

The vein is about two feet wide and as yet the depth and length have not been determined. Through the introduction of the new method of removing the stone from the quarry, a great deal of the danger from dropping fragments has been done away with. All of the workers in the mine are furnished with steel helmets much the same as our soldiers used in the world war. These protect against the falling fragments that attain bullet speed.

The thing which gives the slate its value for electrical purposes is the fact that it is entirely free from metal content. As Monson slate ages it grows blacker, whereas most other varieties turn grey.

The work done at the Monson shops is shipped all over the country.

Special car loading plant by which shipments are made over rails not running into the main plant

Calculation of the Compounds in Portland Cement*

Arithmetical and Diagrammatical Methods

By R. H. Bogue

Portland Cement Association Fellowship, Bureau of Standards, Washington, D. C.

SYSTEMS containing combinations of the components CaO, MgO, Al_2O_3, Fe_2O_3 and SiO_2, have been studied and reported by this and other laboratories (*3, 5, 7, 8, 10* and *11*). It has been found that when these components are intimately mixed in proportions similar to those found in portland cements, and burned to equilibrium, the following compounds are formed: $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, $3CaO \cdot Al_2O_3$, $2CaO \cdot SiO_2$, $3CaO \cdot SiO_2$, and and MgO.

Note—In a former publication (*6*) it was reported that MgO enters into solid solution with $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, the end member of the series being $4CaO \cdot 2MgO \cdot Al_2O_3 \cdot Fe_2O_3$. Magnesia in excess of that required for the above combination was found to remain as uncombined MgO. More recent information obtained in this laboratory indicates that the amount of the solid solution is much smaller than had previously been reported. Although there is no reasonable doubt that a large part of the magnesia remains uncombined, the exact nature and degree of the reaction by which the $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$ is changed in color and pleochroism in the presence of a small amount of magnesia has not been determined. This problem is under further investigation. At present the magnesia may be considered as remaining essentially uncombined, and the iron compound as existing essentially in the form of $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$.

In addition to the five components listed above, commercial portland cements contain small amounts of other materials in variable quantity. These may include soda, potash, titania, manganese oxides, phosphates, and perhaps still other materials. The total amount of these lesser components, however, probably does not often exceed 2%.

The manner of combination of these lesser components is not known. It is possible that some of them, as perhaps the alkalies, may have a significant influence on the relative amounts of the major compounds that are formed, but since the manner of their combination is not yet known, the effects of their presence cannot now be evaluated. Consequently, it is not possible at present to consider those components in the calculation of cement constitution.

It is assumed that the compounds of portland cement are essentially the same as those of the pure five-component system given above when the components are present in the proportions found in commercial cements. The general correctness of this assumption has been confirmed by information obtained from cooling curves (*4*), from microscopic examination (*1*), and from x-ray diffraction photographs (*1*).

Manner of Reaction

The manner in which the components react determines the relative amounts of the resulting compounds. Information obtained at this laboratory leads to the following generalizations:

(1) The ferric oxide reacts with alumina and lime to form $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$. (See note.)

(2) The magnesia remains essentially in the form of uncombined MgO.

(3) The alumina remaining from combination as $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$ reacts with lime to form $3CaO \cdot Al_2O_3$.

(4) The lime remaining from the above combinations reacts with the silica. The compound $2CaO \cdot SiO_2$ is formed, and any CaO then uncombined reacts with the $2CaO \cdot SiO_2$ to form $3CaO \cdot SiO_2$. If CaO remains after converting all of the $2CaO \cdot SiO_2$ to $3CaO \cdot SiO_2$, it will be present as uncombined CaO.

The formation of the compounds as described assumes that a condition of equilibrium has been reached during the progress of the reactions in the kiln. A small amount of uncombined CaO may remain in the clinker, however, indicating (if the composition is such that the CaO would be completely combined at equilibrium) that the reactions are not altogether complete. This departure from complete combination is not usually of sufficient magnitude to produce a change in the nature of the compounds formed, but it does produce a change in the relative amounts of the compounds produced. For that reason it is important that free CaO in the cement be determined (*9*) and that the amount present be taken into consideration in the calculation of the constitution. If this is not done, an error of usually small but uncertain magnitude may be introduced.

The "insoluble residue" obtained in a cement analysis is composed of quartz, titania, and several other materials. The amount of the residue is usually very small, about 0.2%. Because of the low quantity of this material and the variable and uncertain nature of its composition, it seems inexpedient to attempt to introduce a correction factor for it. In unusual cases where the amount of the residue is high, it may be desirable to analyze it to ascertain if an appreciable quantity of silica has remained as free quartz. If the residue is found to contain an appreciable amount of silica, then the silica content of the residue should be deducted from the total SiO_2 to obtain the value of the SiO_2 taking part in the reactions.

The "ignition loss" consists essentially of moisture and carbon dioxide that have been taken up by the cement following the burning operation. In calculating the constitution, this value is accordingly set down without further change.

By means of the information given above, the relative amounts of the compounds present in portland cement or clinker may be calculated from the chemical analysis. It is essential in any case to consider the SO_3 content and calculate that to $CaSO_4$.

Accuracy of Computations

The accuracy of the computations depends on the correctness of both the postulations and the analytical values. The postulations as given represent the best available information, but are subject to revision and extension as has been pointed out. The general correctness of the analytical values will vary with the conditions of test and the personal factor. In any case it is not recommended that analysis be considered as accurate beyond the first decimal place.

An examination of the factors given below will show that errors of analysis often are magnified in the computations for compound composition. Thus a plus error (other values remaining fixed) of 0.2% CaO or uncombined CaO (expressed as percentage of the cement) will increase the computed $3CaO \cdot SiO_2$ about 0.8% and decrease the computed $2CaO \cdot SiO_2$ about 0.6%. A plus error of 0.2% Fe_2O_3 will increase the computed $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$ about 0.6%, decrease the $3CaO \cdot Al_2O_3$ about 0.3%, decrease the $3CaO \cdot SiO_2$ about 0.3%, and increase the $2CaO \cdot SiO_2$ about 0.2%. A plus error of 0.2% Al_2O_3 will increase the computed $3CaO \cdot Al_2O_3$ about 0.5%, decrease the $3CaO \cdot SiO_2$ about 1.3%, and increase the $2CaO \cdot SiO_2$ about 1.0%. A plus error of 0.2% SiO_2 will decrease the computed $3CaO \cdot SiO_2$ about 1.5% and increase the $2CaO \cdot SiO_2$ 1.3%. For these reasons only analytical data that are believed to be reliable should be employed for the computation of compound composi-

*Reprinted from *Industrial and Engineering Chemistry*, Analytical Edition, 1, 4.

tion, and an expression of the compounds $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, $3CaO \cdot Al_2O_3$, $3CaO \cdot SiO_2$, and $2CaO \cdot SiO_2$ should not be given to a closer approximation than the nearest whole number.

Method of Calculation

Each per cent of SO_3 enters into combination with 0.70% CaO to form 1.70% $CaSO_4$:

$$\frac{CaO}{SO_3} = \frac{56.07}{80.065} = 0.70\%\ CaO \quad \ldots\ldots (c_1)$$

Each per cent of Fe_2O_3 enters into combination with 0.64% Al_2O_3:

$$\frac{Al_2O_3}{Fe_2O_3} = \frac{101.92}{159.68} = 0.64\%\ Al_2O_3 \quad \ldots\ldots (a_1)$$

and with 1.40% CaO:

$$\frac{4CaO}{Fe_2O_3} = \frac{224.28}{159.68} = 1.40\%\ CaO \quad \ldots\ldots (c_2)$$

to form 3.04% $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$.

The total MgO is recorded as uncombined MgO.

The total Al_2O_3 minus (a_1) gives the Al_2O_3 (a_2) available for combination as $3CaO \cdot Al_2O_3$. Each per cent. of (a_2) will enter into combination with 1.65% CaO to form 2.65% $3CaO \cdot Al_2O_3$.

$$\frac{3CaO}{Al_2O_3} = \frac{168.21}{101.92} = 1.65\%\ CaO \quad \ldots\ldots (c_3)$$

The amount of CaO available for combination with SiO_2 is obtained by subtracting from the total CaO the sum of the uncombined CaO, the CaO (c_1) combined as $CaSO_4$, the CaO (c_2) combined as $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$ and the CaO (c_3) combined as $3CaO \cdot Al_2O_3$:

Total CaO—(uncombined CaO + c_1 + c_2 + c_3) = CaO available to combine with SiO_2 ..... (c)

The total SiO_2 (s), unless corrected for silica in the "insoluble residue," is calculated first to combine with CaO to form $2CaO \cdot SiO_2$. Each per cent. of SiO_2 (s) will combine with CaO to form 2.87% $2CaO \cdot SiO_2$:

$$\frac{2CaO \cdot SiO_2}{SiO_2} = \frac{172.20}{60.06} = 2.87\%\ 2CaO \cdot SiO_2$$

The first approximation to the value of $2CaO \cdot SiO_2$ is subtracted from the SiO_2 (s) + CaO (c), which gives the CaO (c_4) available to combine with $2CaO \cdot SiO_2$ to form $3CaO \cdot SiO_2$.

Each per cent. of CaO (c_4) combines with $2CaO \cdot SiO_2$ to form 4.07% $3CaO \cdot SiO_2$:

$$\frac{3CaO \cdot SiO_2}{CaO} = \frac{228.27}{56.07} = 4.07\%\ 3CaO \cdot SiO_2$$

The $3CaO \cdot SiO_2$ subtracted from the total SiO_2 (s) + CaO (c) gives the true amount of $2CaO \cdot SiO_2$ present.

If the computed $3CaO \cdot SiO_2$ is greater than $s + c$, no $2CaO \cdot SiO_2$ is present. In that case each per cent. of SiO_2 (s) combines with CaO to form 3.80% $3CaO \cdot SiO_2$:

$$\frac{3CaO \cdot SiO_2}{SiO_2} = \frac{228.27}{60.06} = 3.80\%\ 3CaO \cdot SiO_2$$

This amount of $3CaO \cdot SiO_2$ subtracted from SiO_2 (s) + CaO (c) gives the percentage of uncombined CaO. The above condition can obtain only when the lime is in excess of that which can go into combination at equilibrium, and the uncombined CaO has not been determined and deducted as previously described.

Application of the Method

A diagrammatic method for obtaining these relations has been found useful in computing the amounts of the compounds from chemical analyses. Such a method has not the precision of the mathematical factors, but the values read are probably within the accuracy of the analytical procedures and the method has the advantage of speed and simplicity.

In Figs. 1 and 2 the relations expressed in the factors given above are plotted in a convenient form. As an illustration of the use of the diagrams and the factors, an analysis of a commercial cement and the computation of compounds are presented. A chart (Table I) will be found an aid in the proper recording of the significant figures. The analytical data are given on the chart, together with the values as read from the diagrams. A few abbreviations appear on the chart: C_4AF for $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, C_3A for $3CaO \cdot Al_2O_3$, C_3S for $3CaO \cdot SiO_2$, and C_2S for $2CaO \cdot SiO_2$.

The values for ignition loss, 1.1, and magnesia, 3.7, are transferred to the lower horizontal row, wherein are placed the compounds of the cement.

The value for free CaO, 0.3, is transferred to the "free CaO" column opposite CaO, and brought down to the lower row compounds.

The value for SO_3, 2.0, is transferred to the "SO_3 eq." column, and the CaO equivalent read from the lower diagram in Fig. 1.

In this case only, both readings are taken from the horizontal axis. It is desired to find the CaO equivalent of 2.0 SO_3 in the formation of $CaSO_4$. The point 2.0 on the horizontal axis of the lower diagram in Fig. 1 is followed upward on the vertical co-ordinate until it intercepts the radial line for SO_3. The diagonal co-ordinate is then followed until the radial line for CaO is intercepted. The vertical co-ordinate is again followed down from that point to the horizontal axis, and the value 1.4 is obtained.

The value read, 1.4, is placed at c_1, and the sum of the two, 3.4, is placed at the bottom of the column under "$CaSO_4$."

The value for Fe_2O_3, 3.4, is transferred to the "Fe_2O_3 eq." column and the Al_2O_3 and CaO equivalent to the Fe_2O_3 read from the lower diagram in Fig. 1.

It is desired in this case to find the Al_2O_3 and CaO equivalents of 3.4 Fe_2O_3 in the formation of $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$. The point 3.4 on the vertical axis of the lower diagram in Fig. 1 is followed on the diagonal co-ordinate until it intercepts the radial line for Al_2O_3. The vertical co-ordinate is then followed down from that point and the value 2.2 Al_2O_3 read off on the horizontal axis. The point 3.4 on the vertical axis is again followed on the diagonal co-ordinate until it intercepts the radial line for CaO. Again the vertical co-ordinate is followed downward and the value 4.8 CaO read off on the horizontal axis.

The values as read are placed in the column at their proper places: the Al_2O_3, 2.2 at a_1; and the CaO, 4.8, at c_2. The three figures in the column are now added to give the $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$. This value to the nearest whole number is placed at the base of the column. The amount also may be read directly from the diagram if desired.

The value a_1, 2.2, is subtracted from Al_2O_3, 4.5, to give a_2, 2.3, the Al_2O_3 available to combine at $3CaO \cdot Al_2O_3$, which is placed in the "Al_2O_3 eq." column at a_3. The CaO equivalent of this, 3.8, is read from the upper diagram of Fig. 1 and placed at c_3. The two values are added to give the $3CaO \cdot Al_2O_3$ and that figure to the nearest whole number brought to the foot of the

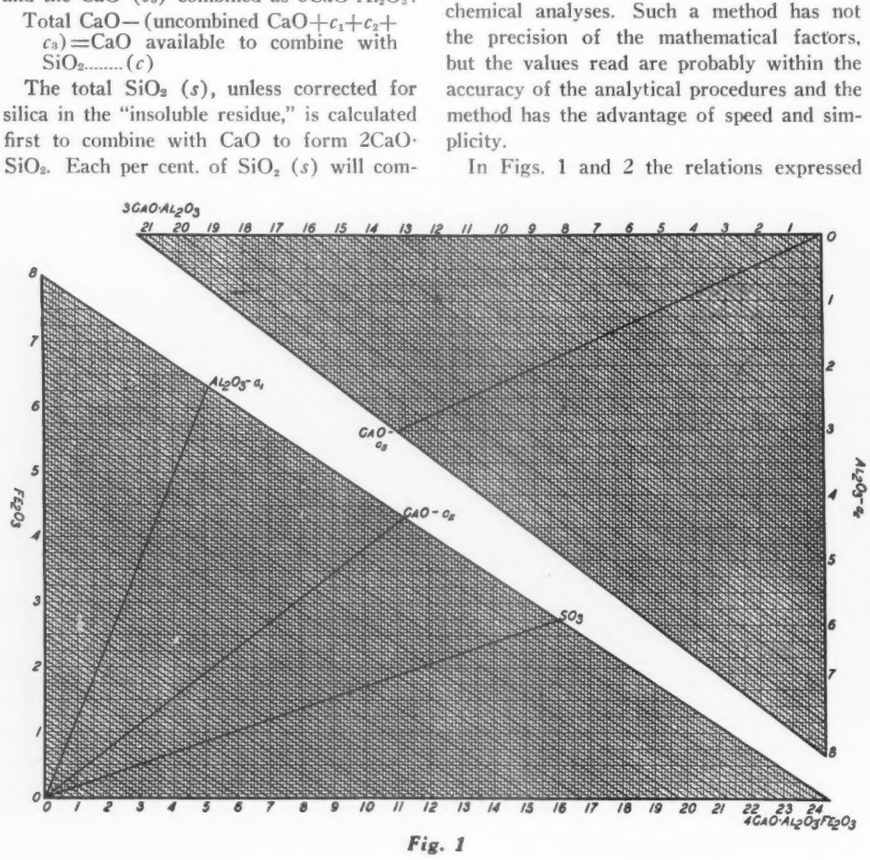


Fig. 1

column. This value also may be read directly if desired.

The CaO, *c*, available for combination with the silica is now found by subtracting from the total CaO the free CaO, c_1, c_2 and c_3: 62.8 − (0.3+1.4+4.8+3.8) = 52.5, which is set down at *c*. The total SiO_2, 22.3 (unless corrected for the quartz in the insoluble residue) is set down at *s*.

The computed tricalcium silicate and dicalcium silicate are now read directly from the diagram (*2*) in Fig. 2. The point is found which is the intersection of the vertical co-ordinate representing SiO_2 (*s*) and the horizontal co-ordinate representing the CaO (*c*) available for combination with the silica. The $3CaO \cdot SiO_2$ corresponding to this point, 44%, is read to the nearest whole number on the diagonal co-ordinate that is parallel to the lower right base line, as indicated. The $2CaO \cdot SiO_2$, 31%, is read on the diagonal co-ordinate that is parallel to the upper left base line, as indicated. These values are set down in the lower row of compounds under C_3S and C_2S, respectively.

In the event that the point represented by the intersection of the co-ordinates for CaO and SiO_2, lies to the left of the diagram, there is present an excess of lime above that required to convert all of the $2CaO \cdot SiO_2$ to $3CaO \cdot SiO_2$. In that case there is some uncombined CaO present and no dicalcium silicate. The tricalcium silicate content is found by reading that value at the point where the SiO_2 co-ordinates intersects the upper left boundary of the figure. The lime required for that compound is then read off on the CaO (horizontal) co-ordinate and the remaining lime is uncombined. For example, consider that $c = 59.0$ and $s = 20.5$. The SiO_2 co-ordinate cuts the upper boundary at a point represented by about 78% $3CaO \cdot SiO_2$. The CaO required is read to be 57.5%. The free CaO is then 1.5%. Such a value should be recorded in the "free CaO" column opposite SiO_2 and brought to the lower row of compounds.

The upper right boundary curve as drawn represents the compositions at which the sum of the two calcium silicates is 80%. The remaining material includes all other compounds—as $3CaO \cdot Al_2O_3$, $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, MgO, alkalies, free CaO if present, $CaSO_4$, and any other constituents. The lower left boundary curve as drawn represents the compositions at which the sum of the two silicates is 65%, the remaining 35% being the other compounds as above. It is probable that most commercial cements fall within these limits, but the diagram may be extended up to the line representing 100% $2CaO \cdot SiO_2$ plus $3CaO \cdot SiO_2$, and down as far as desired. The upper left boundary is the line for zero $2CaO \cdot SiO_2$ and the lower right boundary is cut at 20% $3CaO \cdot SiO_2$ since portland cements will scarcely be found with less than that amount of the tribasic silicate. If desired, however, the diagram may be extended to the lower right to zero $3CaO \cdot SiO_2$.

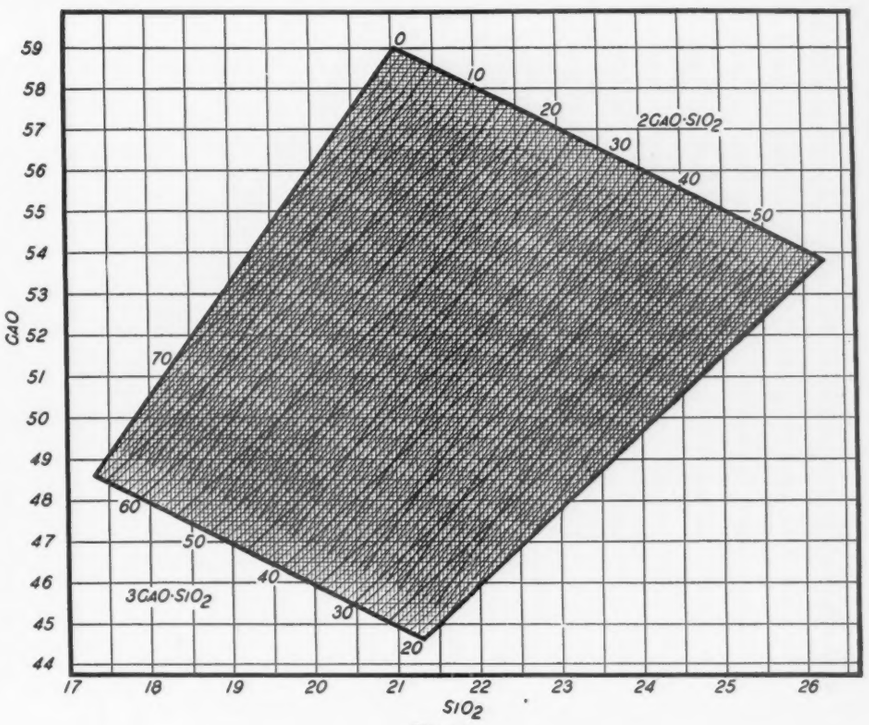


Fig. 2

The data necessary to construct the diagrams in Fig. 1 are obtainable from the factors previously given. The following locations of the external angles of the diagram in Fig. 2 will define the position of that figure:

	Left	Top	Right	Bottom
CaO	48.64	58.95	53.81	44.70
SiO_2	17.36	21.05	26.19	21.30

The diagrams must be prepared with the highest precision and should be drawn to such a scale that estimates may properly be made to 1%.

There now appear on the bottom row of the chart the values for all of the compounds which we are able at present to calculate from the chemical analysis of a cement.

The use of factors in the calculation gives values differing but slightly from those obtained by the use of the diagrams. This is brought out in Table II, in which are shown the values obtained by factors and by the diagrams from the composition represented by the analysis given. In this case, in order to demonstrate the difference, the values are expressed to the first decimal place.

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(9) Lerch and Bogue, *Ind. Eng. Chem.*, **18**, 739 (1926).
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TABLE I. CHART USED FOR RECORDING SIGNIFICANT DATA IN COMPUTATION OF COMPOUNDS

Components	Analysis	Free CaO	SO_3 Eq.	Fe_2O_3 Eq.	Al_2O_3 Eq.	*c* and *s*	C_2S
CaO	62.8	0.3	c_1 1.4	c_2 4.8	c_3 4.8	*c* 52.5	.....
MgO	3.7	....	....	....	....	.....	.....
Al_2O_3	4.5	....	....	a_1 2.2	a_2 2.3	.....	.....
Fe_2O_3	3.4	....	....	3.4	....	.....	.....
SiO_2	22.3	....	....	....	....	*s* 22.3	.....
SO_3	2.0	....	2.0	....	....	.....	.....
Loss	1.1	....	....	....	....	.....	.....
Insoluble	0.1	....	....	....	....	.....	.....
Free CaO	0.3	....	....	....	....	.....	.....
Ignition loss	Free MgO	Free CaO	$CaSO_4$	C_4AF	C_3A	C_3S	C_2S
1.1	3.7	0.3	3.4	10	6	44	31

TABLE II. COMPARISON OF COMPUTATIONS BY FACTORS AND BY DIAGRAM

Components	Analysis	Compounds	By factors	By diagram
CaO	62.8%	$3CaO \cdot SiO_2$	44.4%	44.4%
MgO	3.7	$2CaO \cdot SiO_2$	30.5	30.6
Al_2O_3	4.5	$3CaO \cdot Al_2O_3$	6.1	6.1
Fe_2O_3	3.4	$4CaO \cdot Al_2O_3 \cdot Fe_2O_3$	10.3	10.4
SiO_2	22.3	Free MgO	3.7	3.7
SO_3	2.0	Free CaO	0.3	0.3
Ignition loss	1.1	$CaSO_4$	3.4	3.4
Insoluble*	0.1	Ignition loss	1.1	1.1
Free CaO*	0.3			
Total	99.8%	Total	99.8%	100.0%

*Not included in total.

A Slide-Rule for Calculating Compounds in Portland Cement

Description and Use—Construction and Mathematical Basis of Design

By L. A. Dahl

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THE TRANSLATION of chemical analyses of portland cement and clinker into terms of the compounds present when combination is complete is a tedious operation. A recent article by Dr. R. H. Bogue* describes a graphic method for calculating the compounds now believed to be present in portland cement. It is the purpose of this paper to present the design of a slide-rule† which serves the same purpose. Each compound (except dicalcium silicate) is calculated independently, which is an advantage when only one of the compounds is of interest at the time. The slide-rule is designed to cover the usual range of chemical analyses of portland cement, and does not cover the range in which there is an excess of lime above that which is required to convert all of the silica to tricalcium silicate. The latter range can, however, be covered by an additional simple calculation which will be described later.

Recent work on the constitution of portland cement clinker, referred to in Dr. Bogue's article, has shown that when combination is complete the following compounds are formed: $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, $3CaO \cdot Al_2O_3$, $2CaO \cdot SiO_2$, $3CaO \cdot SiO_2$ and MgO. On the slide-rule, these compounds are abbreviated as follows: C_4AF for $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, C_3A for $3CaO \cdot Al_2O_3$, C_2S for $2CaO \cdot SiO_2$ and C_3S for $3CaO \cdot SiO_2$ following the system used by Rankin and Wright

The slide-rule, which is shown in the accompanying illustration, is of the ordinary Mannheim type. The indicator, or "runner," such as is used on most slide-rules, is not shown in the illustration. C_4AF and $CaSO_4$ are calculated on direct-reading scales, operation of the slide not being required. The remaining compounds are calculated by operations similar to division on an ordinary slide-rule. In the following description of its use the vertical lines passing through A and B on the slide are referred to as the "ends" of the slide. They may be used interchangeably.

*"Calculation of the Compounds in Portland Cement." R. H. Bogue, Journ. Ind. and Eng. Chem., Analytical Edition, Vol. 1, page 192 (1929). Reprinted in ROCK PRODUCTS, this issue, pages 47-49.

†For the convenience of any readers who may wish to make the slide-rule, the design is printed to a scale which will fit the Keuffel and Esser "Beginners" slide-rule, which is available at a low cost.

Calculation of C_3S (Tricalcium Silicate)

1. Set runner over per cent. CaO.
2. Draw per cent. SiO_2 (scale for C_3S) under runner. Set runner over end of slide.
3. Draw per cent. Al_2O_3 under runner. Set runner over end of slide.
4. Draw per cent. SO_3 under runner. Set runner over end of slide.
5. Draw per cent. Fe_2O_3 under runner. Set runner over end of slide.
6. Read per cent. C_3S under runner.

It will be observed that operations 2 to 6 are similar to division on an ordinary slide-rule. Those familiar with the use of a slide-rule may consider the calculation of C_3S as being similar to the operations in calculating the fraction $\frac{CaO}{SiO_2 \times Al_2O_3 \times SO_3 \times Fe_2O_3}$. The order of operations 2 to 5 inclusive may be changed without influencing the result.

Calculation of C_2S (Dicalcium Silicate)

1. Set runner over per cent. C_3S. (If the runner has not been disturbed after calculating C_3S it will be in this position.)
2. Draw per cent. SiO_2 (scale for C_2S) under runner. Set runner over end of slide.
3. Read per cent. C_2S under runner. If the runner is over A, read the result on the A-scale. If over B, read the result on the B-scale.

This operation may be compared with division of C_3S by SiO_2 on an ordinary slide rule.

Calculation of C_3A (Tricalcium Aluminate)

1. Reverse slide and set flush with end of rule, using guide lines A or B. Set runner over per cent. Al_2O_3.
2. Draw per cent. Fe_2O_3 under runner. Set runner over end of slide. Set slide flush with end of rule. Read per cent. C_3A under runner.

This operation may be compared with division of Al_2O_3 by Fe_2O_3.

Calculation of C_4AF and $CaSO_4$

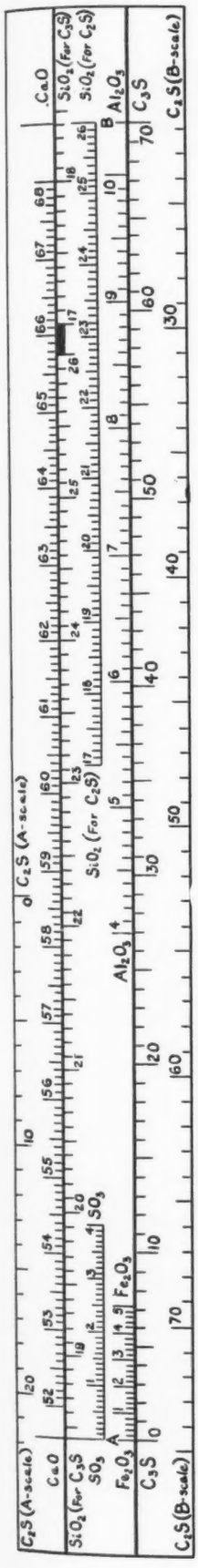
The scales for calculating C_4AF and $CaSO_4$ are on the back of the rule. The per cent. of C_4AF is read directly below the per cent. of Fe_2O_3. For instance, 1% Fe_2O_3 is equivalent to 3.04% C_4AF. The per cent. of $CaSO_4$ is read in the same manner below the per cent. of SO_3.

The slide rule is designed to cover the usual range of portland cement analyses, in which no excess lime is present at complete combination, and in which the C_3S is rarely above 70%. If the analysis is unusual, and it is suspected that the composition is outside this range, the total of the compounds calculated with the slide-rule should be checked. If the total agrees fairly well with the total of SiO_2, Fe_2O_3, Al_2O_3, CaO and SO_3 used in the calculation, the composition is within the range of the slide-rule, and the result is correct. If the analysis is outside the range of the slide-rule, the C_3S will be 70% less than the correct value for C_3S. For instance, 75% C_3S will be read as 5%. Similarly, the C_2S will be 52.8% high. Under these conditions the total will be 17.2% low, which is an indication that the C_3S should be corrected by adding 70%, and the C_2S corrected by subtracting 52.8%. In this way the slide-rule may be used for analyses outside the range for which it is designed.

If an excess of CaO is present above the amount necessary to convert all of the SiO_2 to C_3S the value for C_2S obtained after making the correction described above will be negative, which is to be expected, since in that case no dicalcium silicate is present. The value of C_3S will then be too high, sometimes over 100%. These values of C_3S and C_2S are therefore fictitious. If it is desired, however, to complete the calculation for such compositions by calculating the actual percentage of C_3S and the excess CaO, these fictitious values may be used. The algebraic sum of the fictitious values of C_3S and C_2S will give the sum of the actual C_3S and excess CaO. The actual C_3S, obtained by multiplying the SiO_2 by 3.80, when subtracted from this sum, leaves the per cent. of excess CaO.

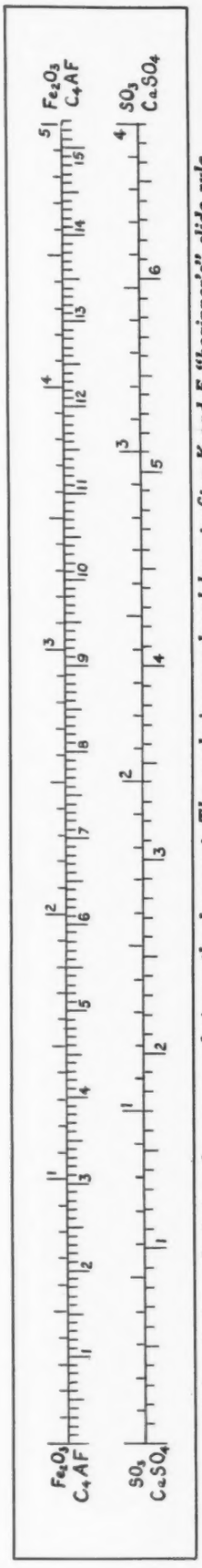
Construction of Scales

Since the scales are uniformly divided, the location of a limited number of points is sufficient for use in constructing the scales, the remaining points being readily



BACK OF SLIDE

BACK OF RULE



Slide rule for calculating the compounds in portland cement. The scale is reproduced here to fit a K and E "beginner's" slide rule

located by the use of dividers. These points are listed below, the distances in each case representing distances from the vertical line A. Negative values represent distances measured to the left of A. The values are based on a 10-inch scale from A to B, but can be multiplied by a factor to make scales of any other length. Two decimal places are sufficient. Three decimal places are given, however, in order that the figures may be multiplied by a factor for a longer slide-rule, if desired, decimals beyond the second place to be dropped after multiplication.

	Per cent.	Dis. (in.)
CaO	52	0.243
CaO	68	9.549
SiO_2 (for C_3S)	18.5	0.089
SiO_2 (for C_3S)	26	8.234
SiO_2 (for C_2S)	17	8.460
SiO_2 (for C_2S)	18.5	10.089
SO_3	4	1.629
SiO_2 (for C_2S)	17	5.114
SiO_2 (for C_2S)	26	10.000
Al_2O_3	4	3.839
Al_2O_3	10	9.597
Fe_2O_3	5	1.020
C_2S (A-scale)	0	4.116
C_2S (A-scale)	22	–0.050
C_2S (B-scale)	22	9.950
C_2S (B-scale)	75	–0.086
Back of slide:		
Al_2O_3	10	10.000
Fe_2O_3	5	3.192
C_3A	26	9.811
Back of rule:		
Fe_2O_3	5	10.000
C_4AF	15	9.859
SO_3	4	10.000
$CaSO_4$	6.8	10.000

Mathematical Basis of Design

As a basis for designing the slide-rule, it was necessary to use equations for direct computation of compounds from the elementary analysis. The derivation of the equations is given below:

(Per 100 grams)	Mol. Wt.
Let v = moles CaO	56.07
Let w = moles SiO_2	60.06
Let x = moles Fe_2O_3	159.68
Let y = moles Al_2O_3	101.94
Let z = moles SO_3	80.064
Let A = moles $3CaO \cdot SiO_2$	228.27
Let B = moles $2CaO \cdot SiO_2$	172.20
Let C = moles $3CaO \cdot Al_2O_3$	270.15
Let D = moles $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$	485.90
Let E = moles $CaO \cdot SO_3$	136.134

Then $3A+2B+3C+4D+E=v$

$A+B=w$

$D=x$

$C+D=y$

$E=z$

Solving:

$A=v-2w-x-3y-z$

$B=3w+x+3y+z-v$, or $B=w-A$

$C=y-x$

$D=x$

$E=z$

Since 1 mole is a gram-molecular-weight, the percentage of any constituent (either oxide or compound) divided by the molecular weight is the number of moles per 100 grams. Therefore, if each term in the equations is divided by the molecular weight of the constituent indicated in that term, the letters will then represent percentages in-

stead of moles per 100 grams. The third equation, for instance, may then be written:

$$\frac{C}{270.15} = \frac{y}{101.94} - \frac{x}{159.68}$$

$$C = \frac{270.15y}{101.94} - \frac{270.15x}{159.68}$$

$$C = 2.6501y - 1.6918x$$

or,

$$3CaO \cdot Al_2O_3 = 2.6501\,Al_2O_3 - 1.6918\,Fe_2O_3$$

Following this procedure in each case, the equations become:

$C_3S = 4.0712CaO - 7.6014SiO_2 - 1.4295Fe_2O_3 - 6.7178Al_2O_3 - 2.8511SO_3$

$C_2S = 8.6014SiO_2 + 1.0784Fe_2O_3 + 5.0677Al_2O_3 + 2.1508SO_3 - 3.0712CaO = 2.8671SiO_2 - 0.7544C_3S$

$C_3A = 2.6501Al_2O_3 - 1.6918Fe_2O_3$

$C_4AF = 3.0430Fe_2O_3$

$CaSO_4 = 1.7003SO_3$

For computations without the slide-rule, correction terms may be introduced to eliminate errors due to dropping decimals, as follows:

$C_3S = 4.07CaO - 7.6SiO_2 - 1.43Fe_2O_3 - 6.72Al_2O_3 - 2.85SO_3 + 0.06$

$C_2S = 2.87SiO_2 - 0.7544C_3S - 0.06$

$C_3A = 2.65Al_2O_3 - 1.69Fe_2O_3$

$C_4AF = 3.04Fe_2O_3 + 0.01$

$CaSO_4 = 1.7SO_3$

All of these equations involve addition or subtraction of terms. The common type of slide-rule is based upon addition or subtraction of logarithms. With logarithmic scales, the slide-rule is used for multiplication or division. With uniformly divided scales, it may be used for addition or subtraction. It is evident that the slide-rule may be used for calculation of compounds from the equations, provided that the scales are uniformly divided, and that the units for the various scales are proportional to the corresponding coefficients in the equations. For instance, in the scales used for calculating C_3S, the scale length for 1% CaO should be 4.07 times the scale length for 1% C_3S, etc. On a 10-inch slide-rule, with a range of 0 to 70% C_3S, the unit for C_3S is one-seventh inch. The position of any point on the CaO scale is found by multiplying the per cent. of CaO by 4.0712/7, or 0.5816. Only the end-points need to be determined, since the scale is divided uniformly. The end-points for the CaO scale are therefore:

$52 \times 0.5816 = 30.243$ in.
$68 \times 0.5816 = 39.549$ in.

To place the end-points as indicated would make the rule more than 3 ft. in length. The scale is evidently too large, but reduction of the scale would mean difficulty in making settings and in reading the scales. This difficulty has been avoided by subtracting 10 or some multiple of 10, whenever such procedure will bring the points within the 10-in. scale of the rule. The positions of the end-points on the CaO scale are therefore:

52% CaO = 0.243 in.
68% CaO = 9.549 in.

Distances are measured from the vertical guide-line passing through A in all cases. The location of points for the other elements is based upon the same principle. On account of dropping the tens digits the reading for C_3S may be incorrect by 10 in. or 70%. This will not occur within the range of analyses for which the slide-rule is designed, but will occur with analyses in which the C_3S is above 70%. For instance, 75% C_3S will be read as 5%.

A similar system of scales for direct calculation of C_2S may be developed. To simplify the slide-rule, however, the value of C_3S already obtained is used in the calculation, using the equation,

$$C_2S = 2.8671SiO_2 - 0.7544C_3S.$$

Since the unit for C_3S (1/7-in. for 1%) is already established the equation is divided by 0.7544 and transposed, as below,

$$C_3S = 3.8007SiO_2 - 1.3256C_2S.$$

These coefficients multiplied by 1/7 will give the scale units for SiO_2 and C_2S. Since C_2S increases with increasing SiO_2 and decreases with increasing C_3S, it is evident that the C_2S scale reads from right to left. The point for 26% SiO_2 is placed arbitrarily on the line B. The point directly under B on the C_2S scale should therefore represent the C_2S when $C_3S = 70$ and $SiO_2 = 26$, or 21.74. With this point located, and the scale determined, all other points on the scale may be located. As in the case of C_3S, the C_2S figure may be incorrect by 10 in. (or 52.81%), when the analysis is outside the range of the slide-rule.

The remaining scales are so easily developed that no explanation is necessary. The scales for Al_2O_3 and C_3A on the back of the slide should be fixed scales, but are placed on the slide because of lack of space on the fixed portion of the Mannheim type rule. This necessitates drawing the slide flush with end of rule when using these scales. A better arrangement would be possible with the duplex type of slide-rule.

One advantage of the slide-rule is that the user has before him at all times a clear picture of the relative effect of errors in analysis on the calculated percentages of the compounds present when combination is complete. Then 1% CaO on the slide-rule is 4.07 times the length of 1% C_3S. It is evident that an error in the CaO determination results in an error 4.07 times as great in the calculated percentage of C_3S.

Flint Pebbles for Boy Scouts

MERLE H. MILLER, of the I. and M. Fire Sets Co., 2919 Shriver Ave., Indianapolis, Ind., manufacturers of Boy Scout steel and flint fire sets, has asked Rock Products' help in locating flint pebbles. He writes: "The size is of no importance so long as they are at least 2 in. in diameter." He wants a price on 500 lb. So, readers, since this is an odd and interesting use for your product, we are giving it free publicity. Please "do your stuff."

Trade Association Financing

VARIOUS METHODS used to finance the work of trade associations are described in a report just made public by the trade association department of the U. S. Chamber of Commerce.

The report is based on information furnished by more than 300 trade associations representing many lines of industry. It emphasizes the need for a sound financial program in order to secure the most effective results in the trade association field.

During the last few years, the report points out, there has been considerable mortality among the trade associations of the country, and one of the most fertile causes has been found to be a lack of sound financing or financial starvation. Too many attempts have been made to run a trade association on a shoestring.

The survey conducted by the Chamber's department disclosed a great variety of methods of financing trade associations. The most generally accepted methods are: Uniform or flat rate, unit of production, volume of business, number of employes, pay roll, capital investment, and agency rating.

"It is interesting to note," the report explains, "that approximately 39% of the associations reporting have adopted the volume of business method. The second method most commonly used is that of uniform or flat rate dues, which is used by 27% of the organizations, while 16% use the unit of production method. Some 4% pay their dues upon the number of employes, while 8% have adopted a combination of methods or have established unusual methods which were not comparable with the above types."

A number of associations, it is shown, establish a minimum due basis regardless of the general method used. The minimum rate ranges from $10 to $750.

According to the report, approximately 50% of the associations reporting have an income of $25,000 and under, whereas more than 10% have an income of $200,000 and more.

Motion Picture Film Depicts the Abrasive Industry

AN educational motion picture film entitled "Manufactured Abrasives" has just been produced by the United States Bureau of Mines, Department of Commerce, in cooperation with a large industrial concern. A number of interesting scenes show the different processes used in making carborundum and other artificial abrasives.

Copies of this film may be obtained for exhibition purposes by applying to the Pittsburgh Experiment Station of the United States Bureau of Mines, Pittsburgh, Penn. No charge is made for the use of the film, only that for transportation.

Converting a Profitless Quarry Operation to Hopeful One

Mobilization of Quarry Equipment at Albany Crushed Stone Co., Feura Bush, N. Y., Proves Success Possible

A PRACTICALLY new plant equipped throughout with modern stone crushing and sizing equipment, all electrically operated —a plant designed to produce 400 tons an hour—yet, never since its inception getting anywhere near this production. This was the status of the Albany Crushed Stone Co. plant at Feura Bush, N. Y., when the Callanan Road Improvement Co. took it over in 1929. The plant was described in detail in ROCK PRODUCTS, December 24, 1924, and October 31, 1925, and at that time the editor pointed out wherein lay some of the faults of the operation.

The Quarry—"Bottle-Neck" of the Operation

When the Callanan company, which had operated a competitive quarry for many years, succeeded to the property, it immediately made necessary changes which would permit the operation to become a profitable enterprise, which strategic location and quality of stone entitled it to be. The chief fault was in the quarry—under previous operating conditions it was not possible to supply sufficient rock to the crushing plant within an economical operating time cycle.

Before going into the changes made a brief picture of the quarry formation and the face development is of interest. The limestone lies on the top of a bluff overlooking the Hudson river valley. It is underlaid with shale, the juncture of the two rocks forming the quarry floor. Herein was presented the first error in design, for the plant engineer miscalculated the quarry floor level with the result that the primary crusher was set nearly 30 ft. below it. This, with

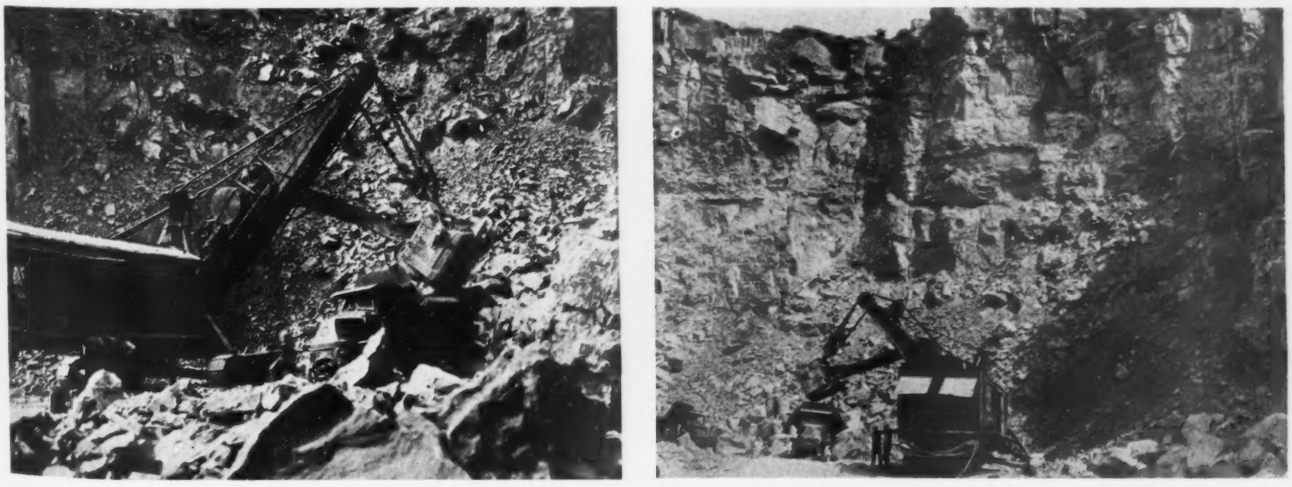
A part of the high quarry face

the fact that the face to be developed was too close to the crusher, made necessary the wasting of a large tonnage of good stone to provide a fairly long winding track for the quarry cars to pass over before they could bring stone to the crusher; a short track would have made too steep a grade. Much money and time was spent in the development of this track system which later under the Callanan management was to be entirely scrapped!

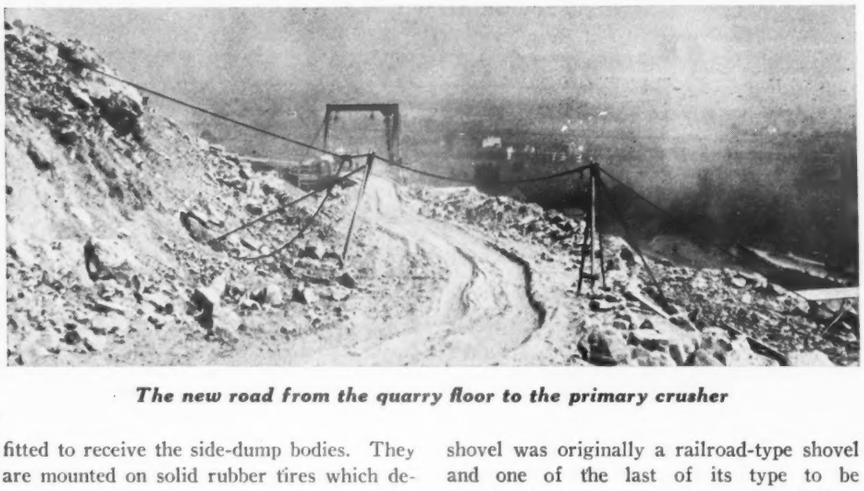
Truck Operation Installed

The Callanan company believed motor truck transportation of quarry stone would prove the economical and desirable method for the Albany plant. Accordingly, they built a circuitous road from the quarry face to the crusher. This was much shorter than the original track line; 800 ft. against 1700 ft. Though the grade was somewhat steep, the motor trucks could negotiate it where locomotive and cars couldn't. There was a wooden trestle at the crusher over which the cars used to run to dump their stone; this was strengthened to permit heavier loads. A Mundy, single-drum, electric hoist was installed on this trestle to dump the trucks. The quarry floor was smoothed a bit to allow the motor trucks to run on it and then the operation was deemed complete. The crux of the situation lay in a steady flow of stone in sufficient quantities and at a fair operating cost, and the mobility of the motor trucks again proved their worth.

There are now four motor trucks in use. These are all four-wheeled, 7½-ton Macks equipped with Phoenix (Easton Car and Construction Co.) steel bodies of 8-cu. yd. capacity. The trucks were bought second-hand, the frames strengthened and the chasses



The 4 cu. yd. electric shovel formerly a railroad type is now mounted on crawler treads. It shows here loading to motor trucks on the quarry floor



The new road from the quarry floor to the primary crusher

fitted to receive the side-dump bodies. They are mounted on solid rubber tires which despite some extremely rough places on the quarry floor which they must continually pass over have stood up quite well. As for the trucks themselves, since installation, about June 1, there have been no repair costs of any kind for them, or for a period of over three months.

Quarry Now Properly Developed

Each truck makes about 60 trips from the quarry face to the crusher in a 10-hr. day, carrying a total load of about 700 tons.

Trucks on the trestle dumping to the primary crusher

The total for the four trucks is then from 2500 to 2800 tons per 10-hr. The crushing plant can easily take care of this amount; in fact, no changes whatsoever have been made in this part of the operation by the Callanan company.

As regards the quarry, a circular face of about 155 ft. in height is carried. Blasts are made three times during the season to bring down about 100,000 tons of rock. Because of the blocky nature of the stone, considerable secondary blasting is necessary. A Marion Model 92-E, electric-powered, shovel on crawler treads, equipped with Ward-Leonard controls and carrying a 4-cu. yd. bucket, loads rock to the motor trucks. This shovel was originally a railroad-type shovel and one of the last of its type to be installed in the quarry industry. The Ward-Leonard system on it has recently been modernized by the makers, General Electric Co. The shovel itself is admittedly somewhat too large and uneconomical for the present operating scheme, but as it is quite an expensive piece of equipment and still in excellent condition, it will not be replaced. It may be that later, when planned developments which will permit more trucks to be used in the quarry, are completed, that the shovel will prove quite suitable.

Changes Made in Short Time

The entire change from rail haulage to motor trucks was completed within three months. This included work on the quarry face and floor, a new road to the crusher, and other incidentals. About 2500 ft. of double track, standard-gage, with 90-lb. rails, was removed and the haulage equipment, which included two 20-ton steam locomotives and five 6-cu. yd. side-dump quarry cars, set aside. The production of stone was increased from 15,000 tons per month to considerably more with quite a cut in the expense of getting out the stone.

The number of men now employed at the quarry and crushing plant is 21, divided as follows:

Primary drills	2
Secondary drills	2
Quarry trucks	4
Crusher and dump	1
Shovel	3
Crushing plant	2
Blacksmith and helper	2
Loading bins	2
Office	1
Supervising personnel	2
Total	21

One of 7 1/2-ton motor trucks and 8 cu. yd. all-steel body

Tractive Resistance of Various Types of Road

FURTHER results of the investigations of certain actions and reactions between road surfaces and the tires used on self-propelling vehicles are incorporated in Bulletin No. 88 of the Engineering Experiment Station, Iowa State College. This investigation is part of a program inaugurated by the Highway Research Board, National Research Council, whose aim is to secure data of value to those concerned with highway problems.

The more significant results are:

Tractive resistance is low on various road surfaces that are reasonably smooth and hard. Earth roads offer a much higher resistance and add greatly to the cost of transportation, particularly when wet. The effect of a spongy sub-grade under a thin road crust (a condition common on light gravel roads) adds 50% to the tractive resistance at 20 m.p.h.—that is, fuel consumption is greater in this case than where the foundation is stable and unyielding. Rough surfaces due to neglected maintenance are nuisances.

An important point brought out is that in the so-called "traffic bound" roads, the loose material of which is placed on the road to be packed by traffic, the cost of compacting is high and indirectly borne by vehicles operating over these roads.

Retarders for Gypsum Plaster

A Digest of United States Patent Literature

By Joseph Rossman
Washington, D. C.

IT HAS BEEN COMMON for many years to use solutions of glue in varying proportions in plasters containing calcined gypsum for the purpose of retarding the setting of the gypsum. To accomplish this, plaster has been mixed with glue-water. It has also been attempted to mix powdered glue with plaster and then mix the two powdered materials with water.

Many other retarders have been used instead of glue. It has also been proposed to add the glue to the plaster by different methods so as to produce better results.

Dry-Type Retarders

The essential feature of the invention of United States patent No. 452,346, for instance, consists in dry-slaking lime with glue-water. The lime so slaked is an essential ingredient in the retarder, whether it be made for a white finishing coat, a gray finishing coat, or for a first coat for brickwork. The first step in preparing the retarder is to dissolve, by weight, one part of good glue in 33 parts of water. This mixture is used for slaking lime. About 4⅛ gal. of the mixture is employed for every bushel of lime. Lime treated in this way slakes into a dry powder. This dry powder is employed in combination to form plastering compounds for the various uses required by the trade. For a fine white finishing coat, three parts by measure of this lime so slaked are mixed with one part of calcined gypsum. For a gray finishing coat, three parts of the lime so slaked are mixed with one part of calcined gypsum, and one part of fine sand. For a white sand finish, the same proportion of white sand is substituted for the common fine sand. For a brown finish first coat for lath-work, three parts of the slaked lime are mixed with one part of calcined gypsum and four parts of fine sand. For first coating for brick work, three parts of the slaked lime, eight parts of fine sand, and one part of calcined gypsum are mixed together. Each of the above compounds is mixed dry and put up in sacks for sale or transportation. When it is desired to use either, it is only necessary to add enough clear water to make a mortar of the desired consistency. If it be desired to have the mortar set slower, the quantity of the glue employed in slaking the lime is increased, and if the setting should be hastened the quantity is decreased, and the proportion of gypsum may be increased, if it be desired, to make the plaster harder.

Liquid Retarders

Liquid retarder has also been combined with dry calcined gypsum as illustrated in United States patent No. 497,948. The gypsum used in the process is calcined and pulverized in the ordinary manner. The dry calcined gypsum is mixed with liquid glue by evenly feeding the one to the other and subjecting them, as they are thus fed together, to any suitable mixing process. The glue is first reduced to a liquid form, and it is desirable to reduce it to this form with a minimum amount of water. For the purpose of maintaining the glue in a suitable liquid condition as it is fed to the dry plaster, as little water as possible is used. It is kept in a heated condition to the point of delivery. This may be done in any suitable way, preferably by the application of steam. It is convenient to unite the two ingredients by running the gypsum and the liquid glue, in regulated and properly proportioned quantities, into the eye of a mill stone and thus pass it between the stones, and thus rubbing or grinding the materials together. It is not necessary to grind the materials for further reduction of the gypsum. Stones with smooth working faces may be used, and of less hardness, with a greater space between them; and thus very little power is required then for grinding.

From ½ lb. to 2 lb. of glue are used to 100 lb. of plaster; but the beneficial qualities of the glue are not limited strictly in this proportion, the length of time required for setting being in direct proportion to the amount of glue used in the composition.

Addition of Glue During Calcining

In carrying out the invention of Patent No. 437,140 the mineral gypsum ($CaSO_4 2H_2O$), which is in a crystalline state, is crushed and ground and then placed in a kettle and subjected to a temperature of 250 deg. to 300 deg. The ordinary effect of this heat is to cause the mass to fuse and become soluble in its water of composition. The water is allowed to gradually boil away until about two-thirds of the water has been eliminated, when the mass turns to a dry powder. While it is in a "molten" condition or before it becomes a dry powder a solution of glue in water is added, about 10 lb. of glue dissolved in 20 qt. of water being about the quantity for each ton of gypsum. This solution of glue fully penetrates the "fluid" mass of boiling plaster and becomes intimately and uniformly mixed therewith, until the glue is homegeneously incorporated with the calcining plaster, which gradually turns to a dry powder, having the glue thoroughly incorporated therewith, and yet possessing full setting properties by reason of the loss of water, so that when the user mixes water with this calcined plaster the affinity of the partially anhydrous gypsum for the water is not diminished, but the presence of the intimately mixed glue prevents the water and gypsum from uniting so rapidly, the glue having first to become dissolved by the water, which causes a retardation of the union between the water and gypsum, and thus delays the setting of the plaster. While the plaster sets slowly so that it can be worked, it sets hard, however, for the affinity between the gypsum and the water is ultimately satisfied, and the glue itself when incorporated in this way adds to the solidity and stability of the compound by forming a cement when hard.

The addition of the glue water to the gypsum while being calcined or boiled not only makes the product very much better by reason of the results above described, but the presence of the glue in the boiling gypsum prevents the water from being expelled to too great an extent in calcining, for it is well known that if too much of the water is driven off from the gypsum in calcining the product loses its ability to reabsorb the water, and hence its setting qualities.

Uses of Gelatine, Starch and Oils

Good results can be obtained with gelatine, soap, albumen, starch, or dextrine, gums, and animal, vegetable and mineral oils, the function of any of these substances when incorporated during the calcination or boiling of the gypsum being to retard the reabsorption of water and delay the setting without interfering with the final result of hardness.

These methods are given as illustrations of the many methods employed in adding retarders to plaster. The following abstracts of United States patents give a survey of the compositions used for retarding the setting of gypsum and artificial stone compositions generally:

Some Early Patents

1. Pelletier 77,705. May 5, 1868.

In combination with the cement composition for preventing its too rapid solidification, solutions of starch, gum, dextrine, sugar, gelatine, borax, or sulphate of ammonia.

2. Gregory 315,936. April 14, 1885.

A partially liquid compound for a foundation coat of plastering, consisting of gypsum, ground and calcined, sand, fresh slaked lime, hair and water, and glue or its equivalent as a retarder.

3. Marsh and Marsh 321,620. July 7, 1885.

The compound for building purposes consisting of calcined gypsum, sand and water, with the addition to it as a means of hardening the compound and delaying the setting for a predetermined time, resin lac dissolved in a solution of caustic soda.

4. McCormic 339,569. April 6, 1886.

A composition for artificial marble or stone, consisting of lime, marble-dust or sand or analogous material, plaster of paris, cement, sulphur and water, with glue, vinegar, molasses or equivalent substance adapted to retard the hardening of the mass.

5. Wooster 367,173. July 26, 1887.

The method of preparing a plaster for walls, cornices, and similar work, which consists in mixing pulverized carbonate of lime and pulverized gypsum, calcining the mixture, and then adding to it a pulverized adhesive material such as glue or gum arabic.

6. King 368,594. August 23, 1887.

The process of making a retarder which consists in mixing with water containing a gelatinous substance a powdered stone, hardening it into a stone-like mass and then regrinding this stone like mas.

7. Coy 390,157. September 25, 1888.

A composition consisting of plaster of paris, sand, whiting, sawdust, glue, Irish moss, molasses and tartaric acid. The last four ingredients, the glue, Irish moss, molasses and tartaric acid constitute a restrainer for checking the setting action of the composition.

8. Fitzgerald 391,899. October 30, 1888.

The invention relates to a composition for the first coat. The compound for this is composed of the following materials, which are mixed in the following proportions: 2½ lb. of sand, 1½ lb. of moderately fine sawdust, 4 lb. of plaster of paris, 4 lb. of slaked lime, ¼ lb. of sugar, and 80 grains of carbonate of soda. The function of the several ingredients is as follows: The sand and lime form the body of the mortar. Sawdust also gives body, but its peculiar agency is to toughen the mortar, so that it will not be damaged by freezing and will be less subject to the influences of heat and cold. The plaster of paris is to give hardness and tenacity, and to secure quick setting and increase its adhering properties. The sugar retards the setting, which would take place too rapidly with plaster of paris alone. It also serves to increase the adhesion and hardening of the plaster. The soda is to lighten the mortar and make it work easily, and it also acts to retard the setting.

9. Fitzgerald 391,890. October 30, 1888.

A plastering composition consisting of cream of tartar, pumice stone, sugar, lime and plaster of paris. The function of the ingredients of this finishing coat is as follows: The cream of tartar is to lighten the skin coat, make it work more easily and rapidly under the trowel, to lay the suction and retard the setting. The pumice stone is to strengthen and harden the body. Sugar is used to give a gloss, retard the setting and give greater tenacity and adhesion. The lime is to give body and whiteness, and the plaster of paris is to secure quick setting, hardness, smoothness and whiteness.

10. King 397,296. February 5, 1889.

A composition composed essentially of animal gelatinous or vegetable glutinous matter and hydrated lime combined and reduced to a finely divided condition.

11. Church 409,012. August 13, 1889.

A composition consisting of gypsum, glue and a fatty matter.

Processes of the Early '90's

12. West 422,171. February 25, 1890.

The object of the invention is chiefly to impart to the plastering material or mineral cement a consistency which allows it to be more easily worked under the trowel or modeling tool. It consists chiefly of a compound of glue or its equivalent and sal soda, which compound is prepared by dissolving 30 lb. of glue in 30 lb. of water or other suitable solvent and mixing with it the sal soda in proportion of 10 lb. of the latter to 30 lb. of glue. This compound is designed to be mixed with plaster or other mineral cements.

13. West 422,269. February 25, 1890.

The invention relates to a composition to be used with plaster of paris, marble dust, talc, soapstone or sand, for plastering and other analogous purposes; and it consists, essentially, of a suitable retarder, preferably glue and dextrine, and in some instances soda combined therewith, and used in about the following proportions: two parts of glue, two parts to three parts of dextrine, and when desired also two parts of sal soda.

14. West 422,270. February 25, 1890.

A retarder consisting of glue, boracic acid and sal soda.

15. Martin and Martin 427,591. May 13, 1890.

A composition for covering walls and other surfaces, consisting of citric acid as a retarder, gypsum, sand and water.

16. Ruston and Hopkins and Ruston 433,743. August 5, 1890.

The method of producing a dry pulverulent restraining compound which consists in dissolving the restraining substance in water and then mixing a dry absorbent material with the solution in closed vessel by stirring under the application of heat and pressure until the mixture is converted into a dry pulverulent substance.

17. Leichsenring 433,899. August 5, 1890.

The composition consists of the following ingredients: One part of glycolline, six parts of water, and plaster of paris in sufficient quantity to make the mass plastic. The composition is applied to the surface or wall while it is in a plastic condition, and the glycolline serves to retard the setting or hardening of the plastic composition for a sufficient length of time after the ingredients are compounded, so that it can be applied by the workman.

18. Sickler 437,140. September 23, 1890.

The process of retarding the setting of plaster of paris which consists in incorporating a retarding agent in the plaster prior to the complete calcining, whereby the retarding agent is uniformly and homogeneously mixed with the finished plaster without deterioration to its final setting qualities.

19. Watson 445,211. January 27, 1891.

A composition to be used for restraining the setting of calcined gypsum, consisting of a solution of the substance of hair and reduced to a powder.

20. Watson 446,604. February 17, 1891.

A composition for restraining the setting of plaster, consisting essentially of a leguminous substance, such as peas, beans, lentils, etc., slaked lime, carbonate of soda, an alkaline earth or a salt of an alkaline earth, or a salt of a caustic alkali.

21. Hart 452,346. May 12, 1891.

A process of mixing glue with lime as a retarder for plastering purposes, which consists in first dissolving glue in water, then adding sufficient of the glue water to lime to slake the lime to a dry powder.

22. Anthony 456,297. July 21, 1891.

A plaster composition consisting of the following ingredients in substantially the proportions stated: Sand, 735 lb.; plaster of paris, 470 lb.; slaked lime, 110 lb.; sawdust, 62 lb.; fiber, 1 lb.; sugar, 0.48 lb.; and bicarbonate of soda, 0.02 lb.

23. Watson 458,742. September 1, 1891.

A compound for restraining the setting of calcined gypsum, which consists of flaxseed or oil meal cake and an alkali combined and reduced to a dry powder.

24. Watson 458,743. September 1, 1891.

In plaster compounds containing calcined gypsum, the addition thereto, as a means of restraining the setting or solidification of it, of a portion of the substance of hoof, horn, or feathers, combined with an alkaline earth or an alkali.

25. Abell 462,678. November 10, 1891.

The composition to be used for covering walls and other surfaces consisting of white lead, litharge, sugar, linseed meal, lime, calcined gypsum, sand and water.

26. Dawson 464,116. December 1, 1891.

A composition composed of glue, linseed meal, and chalk or air slaked lime.

27. Coy 465,614. December 22, 1891.

The method of compounding a retarder consisting in spreading a layer of unslaked quicklime over a floor, then sprinkling the lime with sufficient water to slake it to dry pulverous condition, and then while still

warm, due to the slaking process, sprinkling over it a solution of glue and thoroughly mixing the mass, and then mixing therewith a suitable quantity of flour.

28. Abell 469,394. February 23, 1892.

A composition to be used for covering walls and other surfaces, consisting of dry oxide of zinc, sugar, flour or sulphur, wood pulp, linseed oil cake meal, ground gypsum, lime, sand and water.

29. Watson 472,322. April 5, 1892.

The compound for plaster consisting essentially of calcined gypsum, with the addition thereto, as a means of retarding its solidification, the substance known to renderers of fats as "tank-water."

30. Robinson 472,511. April 5, 1892.

Wall plaster consisting of sand, plaster of paris, glue, lime, clay, alum and starch.

31. Von Slama 474,865. May 17, 1892.

A plastic composition composed of dextrine, gypsum, silicate of soda and vegetable fibers.

32. Cassteel 478,951. July 12, 1892.

A composition consisting of water, lime, gypsum and coke, a mixture of sugar, alum and lime, and a filling material.

33. Dickie 479,060. July 19, 1892.

The composition consisting of sand, plaster of paris, shell marl, glue, alum, sulphate of zinc, lime, and cut rope or hair. This compound is specially adapted for the first coat of plastering. In preparing the second or finishing coat of plastering the cut rope or hair is omitted in the compound and the restrainer, the glue, alum, and sulphate of zinc is used in slightly reduced quantities.

34. Denison 485,177. November 1, 1892.

A compound consisting of lime, cotton seed meal, plaster of paris, borax and cream of tarter. The tendency of the cotton seed meal is to act as a retarder, thereby keeping the plaster from setting too quickly, so that it may be readily worked after it has been put upon the wall, and this is further aided by the addition of the fiber or vegetable tissue, which also imparts the elasticity to the plaster.

35. Bronson 493,613. March 14, 1893.

A composition composed of air slaked lime, glue, flax seed or oil cake, and china clay.

36. Church 497,947. May 23, 1893.

The process of forming a retarder gypsum composed of calcined gypsum and glue which consists in taking the glue in the condition in which it comes from the rendering tank, in the process of making glue, and mixing it without previous drying with calcined gypsum.

37. Church 497,948. May 23, 1893.

The method of combining calcined gypsum and a retarder which consists in evenly feeding together and mixing the gypsum in dry pulverized condition with the retarder in liquid form, whereby a dry composition is produced.

38. Heller 502,096. July 25, 1893.

A compound adapted for admixture with a plaster composition consisting of silicate and carbonate of soda, alum, sugar, senegal-gum, salt-cake and ground china-ware.

39. Heller 502,097. July 25, 1893.

A plaster composition composed of clay, silicate and carbonate of soda, alum, sugar, senegal-gum, salt-cake and ground china-ware.

40. Flynn 503,592. August 22, 1893.

The composition for plastering material consisting of sand or marble dust, plaster of paris, slaked quick lime, talc, mineral pulp and a solution of carbonate of potash and glue absorbed in quick lime.

41. Moore 504,933. September 12, 1893.

The composition consisting of sand, raw gypsum, calcined gypsum, quick lime, glue, sulphuric acid and kerosene oil.

42. Stafford 507,942. October 31, 1893.

The compound to be used for making mortar and coating for walls, consisting of powdered borax, powdered alum, wheat flour, powdered sugar and dry slaked lime.

43. Jones 511,735. December 26, 1893.

Wall plaster consisting of powdered sugar 100 parts, flour 25 parts, powdered air slaked lime 250 parts, plaster of paris, sand and water.

44. McIlvried 511,740. December 26, 1893.

The process of manufacturing a retarding mixture consisting of air slaking lime, keeping it in an air-tight receptacle for a considerable period, then mixing it with water, flour, liquid glue and wood ashes to a consistency of thick paste and then drying it over a slow fire and thoroughly mixing it until it becomes dry.

45. Dawson 511,879. January 2, 1894.

Making a compound to restrain the setting of plaster cement and the like which consists in mixing organic matter and water, holding it at a temperature and for a period to produce fermentation or decomposition, mixing the resultant liquid with lime and then drying and reducing the mass to a fine powder.

46. Dawson 523,658. July 31, 1894.

The process of making a compound to harden and otherwise improve plaster of paris cement and the like, which consists in fermenting and decomposing organic matter in water, mixing the resulting liquid and lime, then adding two parts of nitrate of sodium, more or less, and then drying and reducing the mass to a fine powder.

47. Smith 528,995. November 13, 1894.

Producing a stucco retarding compound consisting in mixing in a dry state unslaked lime and glue and afterward adding a sufficient amount of water to thoroughly slake all the lime while mixed with the glue, and while the mixture is hot thoroughly stirring it so that the glue may come into intimate contact with the boiling lime and adding to the mixture wheat flour and tartaric acid.

48. Aikman 533,420. February 5, 1895.

As an ingredient of building plaster, alum wheat flour, sugar, lime, oil cake meal and sulphate of zinc.

49. Summers 558,435. April 14, 1896.

The plastering composition consisting of furnace slag, slaked lime, plaster of paris, hydraulic cement, the flour of grain and vegetable fiber.

50. Sturcke 619,911. February 21, 1899.

A composition consisting essentially of plaster of paris in the form of a dry powder and dry powdered bone, in which the gelatinous matter is readily soluble in water at ordinary temperatures.

Progress in More Recent Inventions

51. Anderson 927,312. July 6, 1909.

An artificial stone composition comprising granulated stone and cement in approximately equal proportions, with small percentages of lime, soapstone, bicarbonate of soda and alum.

52. Crandall 949,061. February 15, 1910.

A composition for filling cracks and surfacing wood consisting of water 93¾ lb., salt 5 lb., oil of sassafras 1 lb. and glycerin ¼ lb., plaster of paris 80 lb., dextrin 13 lb. and white lead 7 lb.

53. Hermann 1,007,199. October 31, 1911.

Plastic wall coverings consisting of the following ingredients and compounded in the following proportions: 154 parts cement, 30 parts plaster of paris, 96 parts sand, 30 parts powdered coloring matter, 1 part resin and 15 parts dextrin.

54. Bertram 1,051,857. February 4, 1913.

A process of manufacture of materials for the surface coating of walls consisting in first mechanically mixing together a ground carbohydrate and lime, then wetting them and causing a chemical union to form carbohydrate of lime, then drying and grinding the dried mixture and then mechanically mixing the ground base with gypsum in suitable proportions prior to the wetting of it, and finally mixing a suitable quantity of water into the dry mixture.

55. Baker 1,081,565. December 16, 1913.

A wall plaster comprising a quick drying base of gypsum rock, sand and water in combination with a combined binder and retarder consisting of comminuted leather. The leather possesses marked moisture absorbent and retaining qualities, the retention of moisture by the leather retarding the drying of the mass.

56. Campbell 1,106,777. August 11, 1914.

A retarder for plaster comprising lime wastage from the liming of hides which wastage is free from materials having objectionable odors and practically free from inert insoluble animal matter.

57. Campbell 1,106,778. August 11, 1914.

Making a retarder from lime wastage obtained from the liming of hides which comprises converting the insoluble animal mat-

ter in the wastage into soluble matter by cooking the mass in the presence of a suitable alkaline solution, the mass being kept agitated during the period of conversion, cooling the mass kept agitated, then drying the mass kept agitated, in thin films by applied heat, and subsequently grinding the resultant product.

58. Schofer 1,112,725. October 6, 1914.

The method of making fire-resisting cement articles, which comprises mixing cement and a comminuted burnt clay filler with about six parts of water and adding to the mixture about five parts of an alcohol mixed with a small quantity of oil, shaking the mixture down in molds and allowing it to set.

59. Fairfax 1,122,891. December 29, 1914.

A plaster consisting of a mixture of stale beer, apple jelly, salt, plaster of paris and air-slaked lime to which water is added to form a proper consistency for molding and which plaster is characterized by forming a polished surface when cast.

60. Strauss 1,134,964. April 6, 1915.

The method of making plaster retarder comprising extracting the liquid and soluble constituents of bean vines, partially evaporating the extract and absorbing the extract in an earthy absorbent.

61. Duryee 1,151,095. August 24, 1915.

Making gypsum plaster which consists in mixing with the mortar and water or such plaster a retarder consisting of the water soluble extract of bean straw and allowing the plaster to set.

62. Lester 1,157,234. October 19, 1915.

A hydraulic compound comprising substantially 40 parts of hydraulic cement, 32 parts of powdered gypsum, 20 parts of powdered calcined gypsum, 1 part of powdered hydrate and 4 parts of fire clay.

63. Roll 1,308,644. July 1, 1919.

Producing a retarder which consists in subjecting a mixture of animal matter, alkali and hydrated lime in a digester to the heat of an externally applied heating agent until the pressure within the digester reaches approximately 70 to 90 lb.; then cutting off the heating agent and allowing the mass to stand for several hours; then withdrawing from the mass the liquid thus formed; mixing the liquid with hydrated lime in about the proportions specified to produce a liquid mixture of water consistency; evaporating the liquid and grinding the solid thus produced.

64. Culver 1,330,058. April 27, 1920.

The method of making a retarder which consists in mixing together wheat gluten, lime and a sodium compound and, if necessary, adding water thereto to render the mixture in the form of a thin paste, then effecting a boiling of the mixture, after which it is allowed to solidify in mass and is then dried and pulverized.

65. Adamson 1,338,117. April 27, 1920.

A composition consisting of 90% gypsum ore and 10% alunite ore, both calcined at a temperature of 600 to 800 deg. C. comminuted and thoroughly mixed.

66. Mayer 1,360,130. November 23, 1920.

The retarder mixture used consists of the following ingredients:

Talc	200 lb.
Cold water paste	6 lb.
Gum karaya No. 1	1 lb.
Cold water glue	4 lb.
Boric acid	1 lb.

Such a mixture when incorporated in the plaster of paris, a proper amount of water being present, will act as a retarder for the plaster, the degree of retardation being controllable by varying the proportion of the retarder to the plaster of paris. The retarder mixture may either be mixed with water before adding the plaster, or it may be mixed with the plaster and shipped in a dry condition, ready as a whole to be mixed with water and applied to the wall or other surface.

Test of a Concrete Bridge Holds Interest for Aggregate Producers

A BRIDGE OVER the Yadkin River in North Carolina had to be removed to make way for a hydro-electric installation. It was a modern reinforced concrete structure of the hingeless arch type with two 146 ft. spans. There was thus presented an opportunity to thoroughly test a type of bridge which, for aesthetic and other reasons, is coming to be the preferred type in the United States. The North Carolina Highway Commission and the Bureau of Public Roads co-operated in the tests the report of which fills one entire issue of *Public Roads*.

Much of the report is important only to the designers and builders of concrete bridges, but a part of it is directly interesting to the rock products industry. It is interesting to know that the concrete was dense and hard and appeared to be of good quality. The coarse aggregate were stone of several kinds, but all hard and durable and the fine aggregate was a mixture of five parts natural sand to one part of stone screenings. Below the spring line of the arch a 1:2:5 mixture was used; above a 1:2:4 mixture. One set of tests made on cores from this concrete showed an ultimate strength of 4293 lb. and a modulus of elasticity of 3,930,000 lb. This may be compared with the results obtained by testing Maryland road cores, which were of 1:2:4 concrete, recently published in *Public Roads*. These showed an average compressive strength of 3900 lb. and a modulus of elasticity of 3,562,000 lb. The cores from the bridge showed moduli approximately 5% less when wet than when dry.

The question that will interest the general public is whether or not this is a good type of bridge to build. To judge from the conclusions in the report, it is. That is, the theory upon which it was designed is shown to be correct by the results of the tests and the material, reinforced concrete, did all that it was expected to do. An interesting point about this is that the figures seem to show that the concrete was as active in resisting tensile stresses as the steel and that it acts as an elastic material.

A method of analyzing bridge designs by means of a model has come up in comparatively recent years. The model is made of celluloid or some other suitable material and loaded to deform it, the deformation being measured by very accurate gages. Such a model was made for this bridge and its deformation under load was measured and compared with the deformation of the bridge under the loads imposed by the tests. The deformations when plotted were shown to be similar, in some cases the curves were almost identical.

Can Molding Sand Be Improved?

PREVENTION of cracks in steel castings is discussed by Carl Singer in a recent issue of *Die Giesserei*. He believes it is frequently possible to control this trouble by controlling the rate of solidification of the steel in the molds.

Among the methods recommended are: an increased temperature of the molten metal, heated molds, and molding materials which are poor conductors of heat. Probably greatest success would be attained by a combination of all these methods. If steel insufficiently heated is not deoxidized thoroughly it holds an excess of gas which ultimately increases the risk of cracks. It is therefore of importance to keep the steel fluid in the mold as long as possible, and from this point of view it is useful to heat the molds, provided that the heat does not vitrify the sand and create difficulties in shaking out and cleaning the casting.

Use of kieselguhr (diatomaceous earth) or other poor conductors of heat in the molds is well worthy of consideration, provided the material adopted is refractory, plastic, compressible and porous. Kieselguhr is really too porous, as the air which it contains would cause bubbles in the metal. A layer of facing sand corrects this difficulty. Or a mixture of sand and asbestos waste might be used, which, besides decreasing the heat conductivity, would increase greatly the compressive strength.

It is certain that the discovery of an efficient substitute for molding sand would be a very important aid in making those castings which, by their shape, have an inherent tendency to crack during solidification. These could then be cast from very hot metal, well deoxidized, and as free as possible from the gases which contribute so largely to the creation of blowholes and other common defects noted in castings.—*Iron Age*.

Germany's Largest Quarry Blast

By M. Winterstein
Munich, Germany

THE Immenreuth basalt quarry is located in a conical hill which rises between Zinst and Wunchenberg. The rock formation has a columnar face with a close, hard interior (see formation of broken face in Fig. 1). It is quite hard, having a compressive strength of 3600 to 3800 kg./cm.^{2} (from 51,204 to 54,049 lb./in.$_2$). A blasting tunnel was driven 21 m. (69 ft.) into the rock from the southeast towards the northwest of the cone, and two side blasting tunnels of 22 m. (72 ft.) and 28 m. (92 ft.) length constructed at right angles from its terminal (see Fig. 2). The tunnels were 1.7 m. (5.6 ft.) high and from 1.2 to 1.5 m. (3.9 to 4.9 ft.) wide. A blasting chamber was opened at each end of the transversal tunnel, so that four chambers were equally distributed over the 50 m. (164 ft.) tunnel; the volume of these chambers varied from 3.12 to 4.25 cu. m. (4.1 to 5.6 cu. yd.), corresponding to the volume of the powder charge to be placed. The four chambers were located on the front side of the cross tunnel for earlier quarrying operations on the rear side rendered it unsafe to make excavations. The tunnel and the chambers were slightly sloped towards the opening to permit seeping water to flow off.

Loading

Chloratit 2* was used exclusively for blasting. This is an explosive of average shattering power (similar to Ammonia 2 in its action), which due to its good sensitiveness requires no addition of ammonia gelatin primer to insure explosion. The customary addition of 11 to 15% ammonia gelatin would, on account of its high price, make the cost of such a blast too high. The four chambers were loaded with Chloratit 2 as follows: Chamber 1, 2500 kg. (5512 lb.); Chamber 2, 1825 kg. (4023 lb.); Chamber 3, 1825 kg. (4023 lb.); Chamber 4, 2000 kg. (4409 lb.), a total of 8150 kg. (17,968 lb.) of explosive. The electric ignition consisted of blasting caps (connecting fuses for multi-ignition) with 1.7 ohm resistance with rubber insulated copper wire. Each fuse was tested before installation with an ohmmeter having a maximum permissible strength of 30 milliamperes. Since two completely separated cap lines independent of each other had to be provided, each chamber received two series with three electric blasting caps, which were tied with their No. 8 detonating caps into cartridges of 40 mm. (1.6 in.) diameter and suitably sealed. Around each of these percussion cartridges were tied five similar cartridges with a loosely inserted No. 8 detonating cap and placed in the middle of the 2½ kg. (5.5 lb.) packets (percussion packets). The setting off of each of the four chambers was thus effected with 18 detonating caps with a total of 36 gram (2.27 oz.) of detonating mercury. The six percussion packets in each chamber were located nearest the center of the nearly cube shaped chambers. Furthermore, some detonating caps were distributed in the boxes of explosives. The covers were removed from the boxes and the 2.5 kg. (5.5 lb.) packets were stacked without boxes in the middle of the chamber. Because of the seeping water the explosive was protected by a covering of roofing paper. Wooden cross pieces and boards were placed beneath the stacks of explosive to raise them off the bottom, thus protecting against floor water.

***THE BLAST** referred to in this article is not so large — compared with similar blasts made in this country — but the manner in which the data were developed is rather unusual. In the United States such calculations would have been obtained simply and easily, without the use of the carefully worked formulas used here.*

The special precautions to protect the electric wires in the tunnel appear to be extreme and rather involved. One explosive expert of this country, in a similar blast, suspended the wires in the upper corner of the tunnel so that they were out of the way and above the tamping material, thus could not be injured by the weight of the tamping material. Further, in stemming it is customary over here to use the same material taken out of the tunnel while driving it; this gives effective tamping and if handled properly requires nothing further.

Wiring Details

The electric fuses in the chambers were connected in series and before connection to the ignition cable were tested each time from the outside by the ohmmeter. Contact points of the fuses among each other and with the ignition line were protected for safety and possible damage, especially moisture, by drawing rubber tubing over them. Rubber insulated cable with a copper core of 1 sq. mm. (0.00155 sq. in.) cross section was used for the firing line. Within the tunnels the wires were placed by an electrician in a conductor tube insulated on the inside with tar asphalt. The two separate lines were then placed in lath partitions, one to the right and one to the left

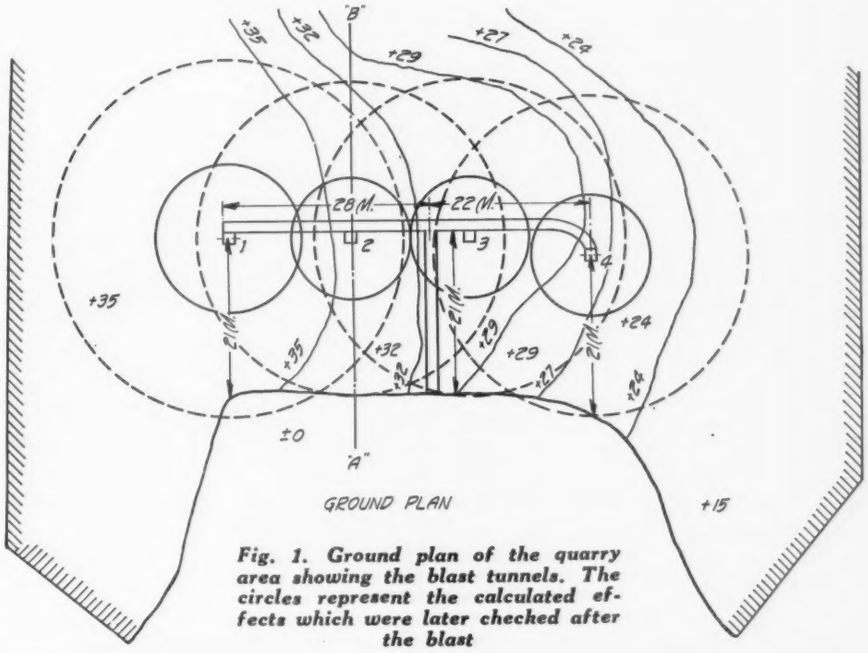


Fig. 1. Ground plan of the quarry area showing the blast tunnels. The circles represent the calculated effects which were later checked after the blast

*Chloratit 2 is a chlorate of potash-nitro compound which is comparable to 40% ammonia dynamite, although the latter is more sensitive and does not require the precaution followed here to insure detonation.—Editor's Note.

at the upper side of the tunnels so that they were protected from the pressure of the filling material of the tunnel and so that both would not be cut off simultaneously if an unforeseen dropping of the rock should take place (see Figs. 3 and 4).

After all lines and connections of the chambers had been completed and tested again with the ohmmeter loading was started. Chambers 1 and 4 were concreted shut, warm water and soda being used to effect quicker setting of the cement. Due to shortage in time and snow and ice on the concreting material, a good setting was no longer insured so that all vacant spaces up to the entrance of the tunnel were filled

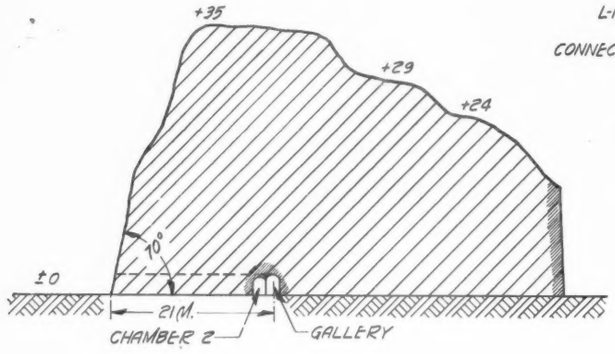


Fig. 2. Section through the quarry face

with paper cement bags filled with fine gravel and with boxes filled with chips.

The measurement of the resistances of the fuses and lines gave the following results for each closed circuit:

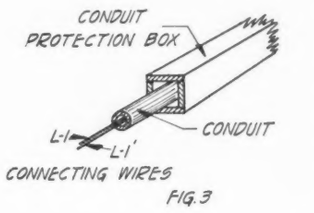
12 fuses of 1.7 ohm each	20.4 ohm
Line in tunnel to entrance	2.0 ohm
Line outside of tunnel	2.0 ohm
Total	24.4 ohm

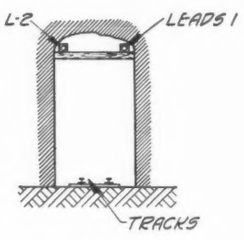
Before the setting off, the line measured 25.0 ohm.

Safety Precautions

The government authorities provided the following regulations for safety: The date of blasting was set for Wednesday, January 16, 1929, at 2:30 p.m. The blasting range set at a radius of 500 m. (1640 ft.) was guarded so closely by a chain of guards around the quarry that secret entrance was entirely impossible; the guard remained after the blast until discharged by the authorities. No unauthorized person was permitted within the blasting range. The regulations for chamber blasting of the Quarry Association were to be followed carefully in loading, installation of the priming lines and in all other operations. On the day previous, when the tunnels were already loaded, the greatest possible care was maintained in the working operations around the quarry. Blastings of broken rock was done with the smallest charges possible and two or more such charges never set off simultaneously. All buildings within the blasting range had to be evacuated. The blasting dump was not to be entered before Thursday morning and even then only with special permission from the blasting director, Maj. A. D. Winterstein. Blasting material and fuses not used were returned at once to the store house. The time for blasting was indicated by red flags and sound signals.

The time of blasting was delayed one hour, to 3:30, to allow the Geophysical Institute of the University of Goettingen to make preparations for scientific observations. For these recordings a cable from its quarters in the basement of the canteen building to the entrance of the tunnel was laid. In each of the two blasting cables there was installed an insulated ignition fuse fastened to the measuring cable, so that the measuring cable would be disconnected by the set-off and thus record the start of the blast. The recording office had contact by wireless telegraph with the seismographic station of the universities of Goettingen, Frankfurt and Jena to give the places the exact time of the set-off, so that apparatus for recording could be adjusted. The blast occurred at 3:29:30 p.m. exactly as desired by the seismographic recording office. A 30-charge military priming machine of Siemen and Halske make was used for the electric set-off, the director personally setting off the blast from a distance of 130 m. (459 ft.). A detonation and a hurling of the rock did not occur as expected; there was merely a hollow roar and the noise of the collapsing rocks. The blast was also photographed by the director of the Immenreuth quarry from the position of the man setting off the charge. The rock dislodged was estimated at 120,000 to 135,000 cu. m. (156,949 to 176,568 cu. yd.).





Figs. 3 and 4. Details of the electrical preparation

Entrance to the blasting tunnel driven into the quarry face

Calculating the Charges and Their Effect

The charges were calculated according to the blasting regulations for pioneers according to the Hauser formula:

$$L = w^3 \times c \times d$$

in which:

L = the charge in kg.
w = the effective radius in meters (tunnel length).
c = the charge coefficient (figure of strength); that is, the relation of the strength of the rock to be blasted, etc., to the energy of the explosive.
d = the stopping up or damming figure, dependent on the position of the charge and the kind of damming material used.

Since special attention was given to a good stemming of the chambers and the tunnel, in the above formula the value for d can be placed at one-half, thus the value for L becomes $w^3 \times c$. According to the details of the above directions, this formula signifies an effect of *destruction* (complete breaking up) as it is demanded under miliary conditions. However, in peace time blasting, work with destructive charges in which the blasted parts fly about for 1000 m. (3281 ft.) or more and where a deep hole results from the blast are not used; only so called *concussion* charges, the charges for which are determined by test blasts and are in general located within the limits of ⅓ to ⅛ of the *destruction* charges figured for the same sphere of action. It must be considered that in the more vigorous *concussion* charges the rock is still thoroughly broken up and that the flying about of broken debris within a wide range is still to be expected.

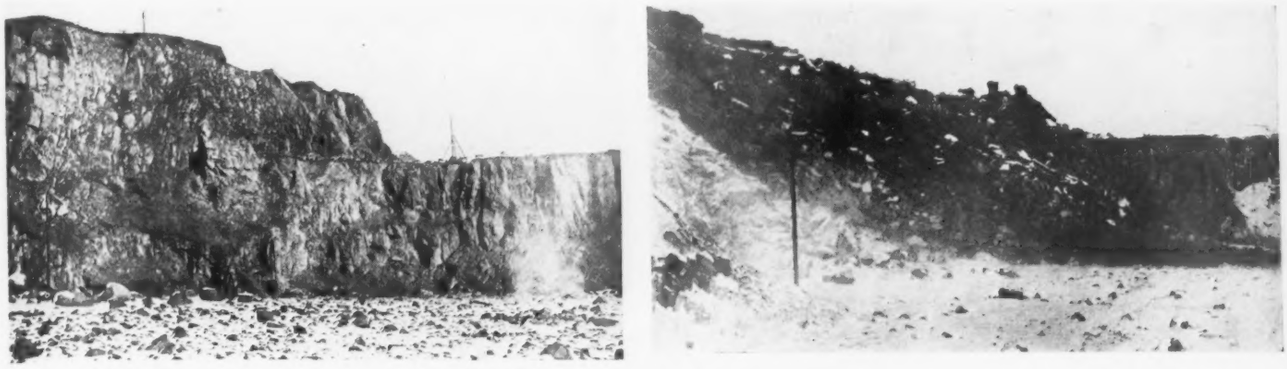
Previous blasting data shows that for Chloratit 2 the value for c as concussion charge is between 1/13 to 1/15 of the figured destruction charge and that it is dependent on the figure of the tunnel length (w), the strengths of the rock to be blasted and the shattering power (quickness or speed) of the

explosives used. For all four chambers the tunnel length (w) was 21 m. (69 ft.), therefore the destruction charge would be:

$L = w^3 \times c \times d$ or $21^3 \times 3 \times 1 = 9261 \times 3 = 27{,}788$ kg.

in dotted lines) intersect reciprocally beyond the individual chambers and touch the rock wall (chambers 2 and 3) or overlap somewhat (chambers 1 and 4). The success of the blast showed the correctness of the above

cables, a broken cable was indicated in chamber 2. This was not yet sealed up, so that the middle fuse which was damaged was replaced. Apparently the fine German silver or platinum wire in the detonating cap



Quarry face before (left) and after the blast

From this the concussion charge is figured as follows:

$27{,}788 \div 13 = 2137$
$27{,}788 \div 14 = 1985$
$27{,}788 \div 15 = 1852$

Therefore the average is $5974 \div 3 = 1991$ (roundly 2000 kg.).

Accordingly for all four chambers $2000 \times 4 = 8000$ kg.

This calculation may be simplified by expressing the quotient from the *destruction* and *concussion* coefficients decimally as follows:

$3/13 = 0.2307$
$3/14 = 0.2143$
$3/15 = 0.2000$

The average, $0.6450 \div 3 = 0.215$. Therefore $9261 \times 0.215 = 1991$, or roughly 2000 kg. (4480 lb.) per chamber, as above.

The four chambers were not charged uniformly, even though all had the same tunnel length of 21 m. (69 ft.). This action was based upon the following consideration: Chamber 1 located at the extreme left (see Fig. 2) was situated exceedingly close to the left corner of the 35 m. (115 ft.) rock face. The face here runs back almost at a right angle so that a continuation of the wall at the left side of the quarry would still meet the chamber. Here the greatest force had to be exerted. The chamber 4 located at the extreme right was also well "tightened in" as compared to the two middle chambers 2 and 3, though not to the same extent as chamber 1. Chamber 4 was located also on the border of the shattered quarry face (see Fig. 2). The height at this point ranged from 24 to 29 m. If accordingly chambers 1 and 4 did their work properly, then chambers 2 and 3 would merely help vigorously and the final results would be certain.

As a test, a plot of the effect was constructed (see Fig. 1). From this it may be seen that the *circles of destruction* meet each other, or slightly overlap in chambers 1 and 2, where as the *circles of concussion* (drawn

consideration. Checking of the values for "w" gave the following results in the determination of the charges:

When $L = w^3 \times c \times d$, then the value for w becomes as follows:

$$w = \sqrt[3]{\frac{L}{c \times d}}, \text{ therefore}$$

For chamber 1 $= \sqrt[3]{\frac{2500}{3 \times 1}} = 9.41$ m.*

For chamber 2 $= \sqrt[3]{\frac{1825}{3 \times 1}} = 8.47$ m.*

For chamber 3 $= \sqrt[3]{\frac{1825}{3 \times 1}} = 8.47$ m.*

For chamber 4 $= \sqrt[3]{\frac{2000}{3 \times 1}} = 8.74$ m.*

**Destruction radius.*

The values of the concussion coefficients (c_1) are calculated easily since the values for the charges (L) are now known, namely:

For chamber 1, $c_1 = 2500 \div 9261 = 0.269$ or roughly 0.27.
For chambers 2 and 3, $c_1 = 1825 \div 9261 = 0.194$ or roughly 0.19.
For chamber 4, $c_1 = 2000 \div 9261 = 0.215$ or roughly 0.22.

Conclusions

The Kemnath district board specified in its permit that blasting of loose rock with the smallest possible charges could be carried on though the chambers were charged, with the added stipulation that blasts should not occur simultaneously. Blasting on the broken face was not permitted. These blasts were carried out at noon and evening daily so the demand for basalt at the plant could be met. A rather strong air pressure was noticeable during this blasting. On the evening of January 14, when testing the electric

was broken by the vibration, for earlier tests at noon of the same day showed all cables to be intact. Thus it is best to discontinue all blasting at the quarry after the chambers are loaded. Perhaps tight blocking of the entrance to the tunnel by a heavy plank door during any small blasting would suffice.

The construction of the tunnels required 51 days with two shifts of 10½ hr. each and the four chambers were loaded with 8150 kg. (17,968 lb.) of explosive within seven hours, including the testing of the ignition fuses and preparation of the percussion caps and percussion packets. It required 18 hours for the construction of the two ignition lines; this time includes the placing of each in a separate 145 m. (475 ft.) long insulated conductor piping and two independent lattice partitions for each, and also the repeated testing of the cable resistances with the ohmmeter and installation of the two long-distance cables, each of 150 m. (492 ft.) length. The damming or filling in of the entire tunnel and walling in of the chambers 1 and 4 required 48 hours. The tunnel length was made, contrary to the specifications for chamber blasting, not equal to one-half but equal to two-thirds of the height of the broken face. This change was based upon the desire of the quarry management to obtain a development of at least 100,000 cu. m. (130,790 cu. yd.) and more. The costs per ton of stone dislodged were thereby somewhat less. In the first case (with a one-half height of broken face) a total length of 58 m. (190 ft.) of tunnel would have been required with a tunnel depth of 16 m. (52 ft.), in place of a length of 71 m. (233 ft.). This would have saved only about six or seven working days and required a charge of 3600 kg. (7937 lb.) to dislodge only 57,000 cu. m. (74,553 cu. yd.) of rock.

From estimates the cost of the dislodged rock resulting from the above blast is about 15 to 20 pfennig per cu. m. (4 to 6.5 cents per cu. yd.).

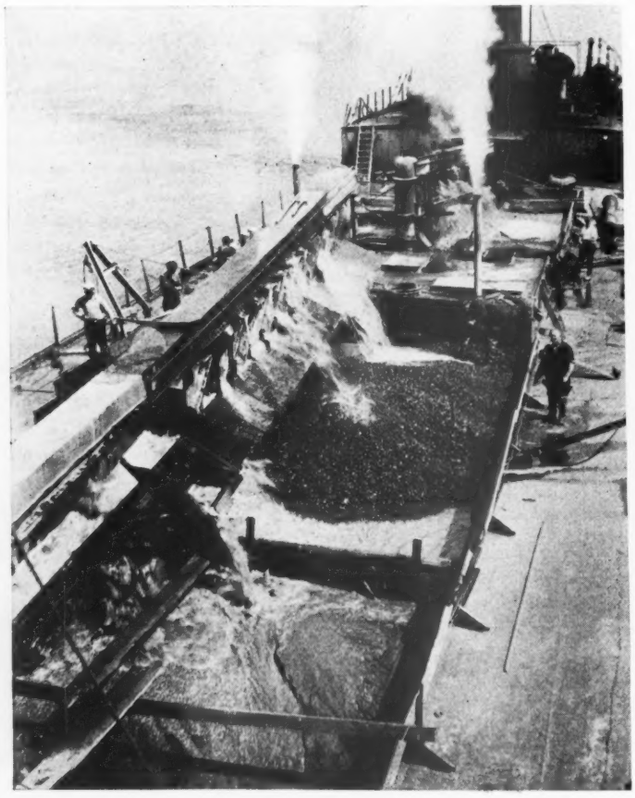
New type of boat operated by the Gravel Products Corp., Buffalo, N. Y. The material dredged from the lake is washed, screened and stored in the boat

Sea-Going Sand and Gravel Plant

Unique Boat Operated by the Gravel Products Corp., Buffalo, N. Y., Acts as Dredge, Washing Plant and Carrier for Sized Sand and Gravel

A NEW type of apparatus, specifically designed to wash and separate dredged materials on the carrying boat, has been patented by Howard S. Gerken, Buffalo, N. Y. The patent, U. S. No. 1,729,070, has been assigned to the Gravel Products Corp., Buffalo, who have built and equipped a boat in accordance with the patent specifications and is now operating it in Lake Erie.

Under the invention, the material pumped from the waterway is given a primary separation on board the ship; the unwanted material such as large stones and other foreign matter is rejected, passing back into the lake by means of the upper flume. Then the gravel, sand, silt and water pass on to secondary screens. Here a large quantity of washing water is added and the dirt carried overboard by secondary flumes. The gravel is carried off into separate bins and the sand to settling boxes which are provided with automatic means for dumping this washed material without excess water into separate compartments in the hold of the vessel.



The sizing and washing apparatus on board the boat in actual operation

The separating, grading and washing apparatus is positioned lengthwise of the boat and over the hold or hatches. Graded material can be delivered to any part of the hold so that segregation of materials and even loading of the boat may be accomplished. The apparatus itself is mounted in such a fashion that it can be moved bodily to a lateral position on the boat so as to give unobstructed access to the hold for unloading. It may also be collapsed or lowered to form a compact unit close to the deck which will avoid swaying and dislocation during rough weather.

Operation

The dredging pump, installed on the boat, discharges to the upper end of an inclined chute or flume extending lengthwise of the boat over the hatchways which are divided into compartments. Coarse separating or screening units are arranged in spaced relation along the bottom of the chute and all the gravel and sand to be retained passes through these together with some water. Rocks and undesirable material pass over the screens and are discharged from the lower end of the chute to a hopper and thence carried overboard by pipe.

The throughs of the primary screens fall to a chute directly underneath, off which at different intervals along its length and on both sides are placed inclined screening units. On these screens the secondary separation is made, gravel and coarse material falling to compartments below and the water and sand and other fine material being received by a lower trough. This trough is provided with spaced washing and settling box units into which the sand collects, is

washed and then intermittently discharged into receiving compartments in the hold.

Screen Construction

The primary screen is of the bar grizzly type with removable bars to allow any spacing desired. It is assembled as a unit which may be moved as a whole. Discharge of the material through the screen is controlled by a pair of slide gates which can be adjusted to direct the flow amidship or either side and to one part of the boat or another. Arrangement has been made for by-passing the primary screens and chuting the material to the secondary screens or compartments. Each of the primary screens has a flat baffle plate of the same size as the screen opening and which is placed between the screen and the discharge gates. A central opening has been cut in these baffles which is considerably less than the screen opening; the surrounding ledges on the baffles serve to break up the velocity of the material and water flowing to the screen and act to change this flow from its oblique and laterally spreading course to a straight downward fall through the screens. This feature is particularly useful when the material is discharged directly to the washing and settling units.

The secondary or intermediate screen is also of the inclined bar grizzly type, the bars locked in a suitable screen frame; the screen frames are pivotally connected to each other and supported at their upper ends by means of a hinge rod. Material from the primary screens flows downward to the intermediate screens and the sand and water passing the screen goes to the sand washers, while the gravel tails off over the lower end and falls through open hatches into the hold of the boat. Suitable deflecting plates are placed at the top and ends of the screen to prevent any spillage. These screens are also adjustable to different inclinations so as to retard or accelerate the velocity of the material passing over them and thus control the separation.

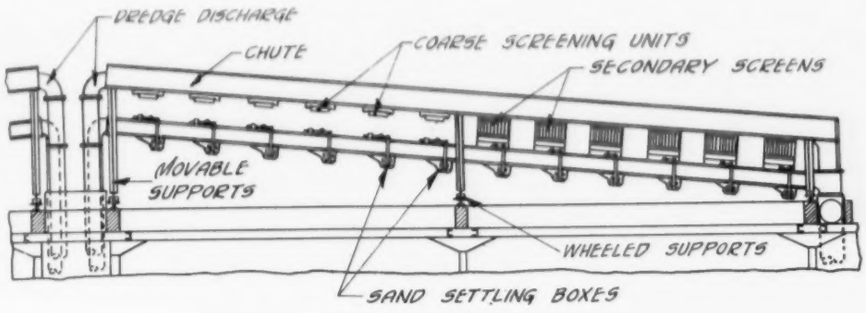


FIG. 1

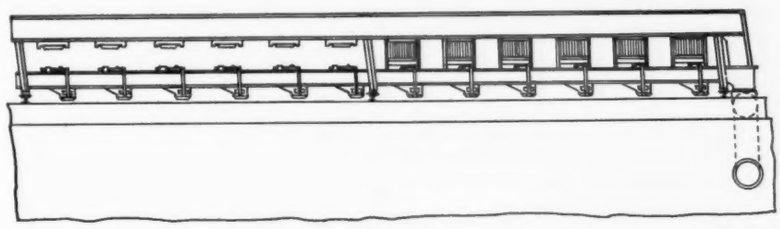
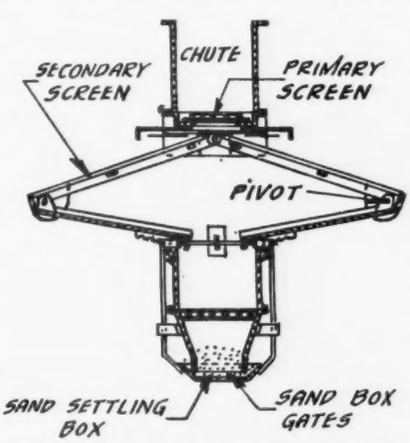


FIG. 2

Fig. 1. Side elevation of the material washing, separating and grading apparatus arranged lengthwise over the hatches of the deck. Fig. 2 is a similar view in the inoperative or collapsed position

The sand and more or less muddy water passing the intermediate screens is deposited in a trough where it is met by a current of water which flowing into the boxes creates a thorough agitation of the material and the sand gradually settles on the valves at the bottom of the settling box, while the mud is held in suspension and carried down the trough with the water. The bottom valves of each box section are counterweighted so that each section and its feeding hopper must be filled with sand before they are forced to open. As the gates open, some of the sand spills out and this loss in weight causes the counterweights to return the gates to the closed position. Thus there is always a layer or seal of sand in the bottom of the box, sufficient to prevent the water above the sand from flowing out of the box and into the hold of the boat. The action of the gates is entirely automatic and they work according to the adjustment of the counterweights.



Transverse vertical section through the apparatus

Collapsible Design of Equipment

The washing, grading and separating apparatus can be moved to different positions along the length of the boat over other portions of the hatchways. Also, this apparatus can be shifted to one side of the hatches to leave them unobstructed for unloading. For this purpose the lower legs of the frame are connected to wheeled trucks adapted to travel on guide tracks or rails mounted on the hatch coaming or other parts of the boat. Removable extension rails are arranged transversely of the deck at one side of the boat and in line with the other track rails, so that the entire apparatus can be moved laterally after disconnection of the necessary fittings. The legs of the supporting frame are of knockdown construction so that on disconnection of fittings the chutes, troughs, separating units, etc., may be reduced in height to allow unloading apparatus to move over them and along the boat. The above apparatus can be collapsed entirely to lie flat on the deck and securely lashed during rough weather.

Coming Census of Manufactures

FOR THE FIRST TIME the Census of Manufactures to be taken early in 1930 will call for information on the practice of manufacturers with respect to the number of days that constitutes the normal working week of their plants, the advisory committee on the Census of Manufactures announced recently. Specifically the advisory committee points out inquiry will be made as to whether the workers in each plant are on a six-day basis, five and one-half day basis or on a five-day basis per week. During the past two or three years there has been much speculation on this subject, but exact facts of a nation-wide scope have not been available.

Manufacturers will also be asked to give information on the number of shifts per day and the number of hours of labor per week, and the data on these matters will be more extensive than at any census since 1919. In addition there will be the usual questions on the number of wage earners and salaried persons, including monthly figures by which employed; the seasonal variations of employment in the several lines of manufacturing can be measured; and on the growing use of power and power equipment, a subject of interest to manufacturers and workers.

Gravel Plant Washing and Screening Equipment and Design

Part VIII—One Solution to the Storage Problem

By Hugo W. Weimer
Consulting Engineer, Milwaukee, Wisconsin

PART VII of this series was published October 13, 1928. This, the concluding article of the series, deals with a problem that confronts many operators of both existing and proposed sand and gravel washing plants—namely, the storage of more material than bins of average size will hold. While a plan is illustrated, it is not the writer's intention to illustrate merely a plant design that is undoubtedly familiar to many readers, but chiefly to indicate how the use of a bottomless drag bucket or scraper may be applied not only to the digging and delivery of material from the pit to the plant, but also to the storing and reclaiming of finished product passing through the plant. This type of equipment is also termed power drag scraper, cable drag scraper and power plow scraper. A scraper unit consists of a bucket, blocks and attachments, operating cables, guys and attachments, bridle anchorage, power units, hoists and the necessary masts and towers. A typical design of bucket is shown in Fig. 1, which clearly illustrates the principle of the bottomless feature. The use of this bucket is no longer an experiment and there are numerous manufacturers who are in a position to furnish this equipment, and when used in the proper place excellent results should be obtained. Fig. 2 illustrates how these scrapers excavate and convey the material in the pit to the delivery point. Figs. 3 and 4 show an outline together with general dimensions of a typical sand and gravel plant provided with a preliminary screening and crushing plant independent of the washing plant which is equipped with the usual washing screen and sand separator device. In addition to this usual design, a rather unique method is shown for providing a large storage capacity and at the same time a reclaiming method all by the use of one drag scraper. No attempt is made to describe the plant in detail; only the equipment is listed, as follows:

Fig. 1. Typical design of bottomless scraper bucket

(1) A field hopper provided with a grizzly on the top to receive the material from the pit and to remove that too large for the crusher opening. There is also provided at the bottom a feeder for delivering the material to the first belt conveyor.

(2) A belt conveyor for receiving the material from the hopper feeder and delivering it to the scalping screen.

(3) A scalping screen to regulate the maximum size of material to be produced by the plant from which the oversize is passed on to the crusher (4) and everything passing through a required opening in the screen to the belt conveyor (6) for delivery to the washing plant.

Fig. 2. Illustrating method by which scrapers excavate and convey material in the pit to delivery point

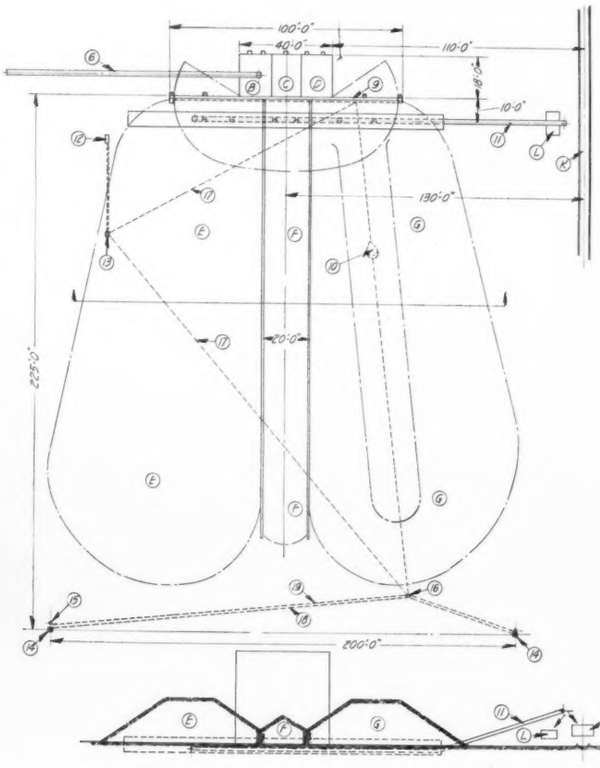


Fig. 4. Plan for large storage capacity and reclaiming for plant (Fig. 3)

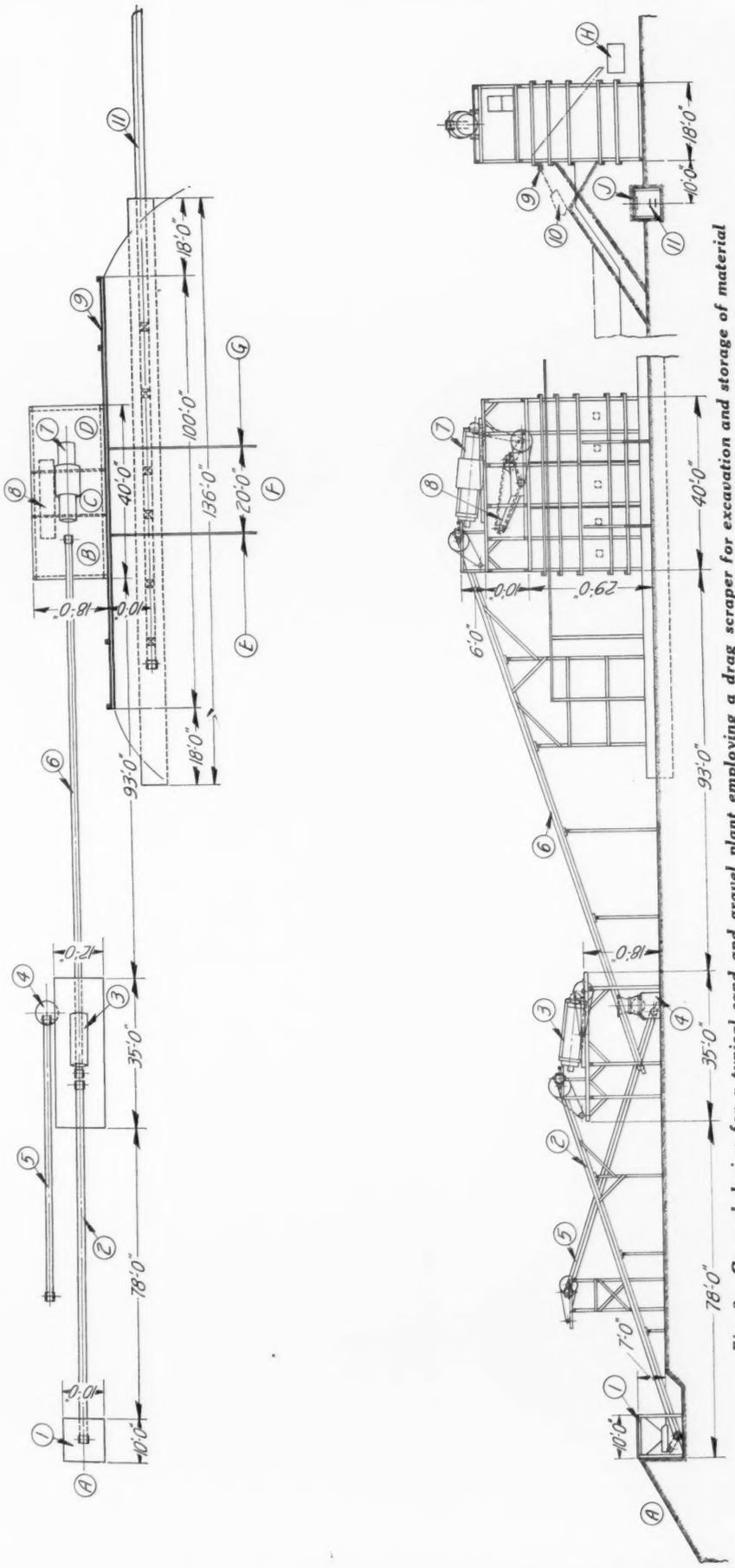


Fig. 3. General design for a typical sand and gravel plant employing a drag scraper for excavation and storage of material

(4) This is the only crusher used in this plant and therefore functions both as a primary and secondary crusher.

(5) Belt conveyor for taking the material from the crusher and returning it to the first belt conveyor which again delivers it to the scalping screen, thus providing a closed circuit regulating the material to a certain size which is delivered to the washing plant.

(6) Belt conveyor for receiving the material from the scalping screen and delivering it to the washing plant.

(7) Cylindrical rotary type of scrubbing, washing and sizing screen. This screen produces two sizes of finished gravel and in addition segregates the sand and water which is passed on to the sand separator (8).

(8) This device provides further washing for the sand and separates same from the water before delivering sand to the bin compartment. From this sand separator a flume is provided for delivery of the water and clay or dirt as the case may be to a settling pond or sump.

Nos. 9 to 19 refer particularly to the storage and reclaiming device and will be described more fully in following paragraphs. On Figs. 3 and 4, there are indicated various points which are described as follows:

(a) Incline where the drag scraper delivers the material to field hopper. Fig. 5 is a photographic illustration of the arrangement in the pit for the use of a drag scraper for excavating and conveying the material to the field hopper. The equipment for this unit is listed in the fore part of this article.

(b) Bin compartment for receiving the sand from the separator (8).

(c) Bin compartment for fine gravel.

(d) Bin compartment for coarse gravel.

(e) Ground storage for sand.

(f) Ground storage for fine gravel.

(g) Ground storage for coarse gravel.

(h) Arrangement for delivery of material direct from bins to trucks.

(j) Tunnel under the storage piles located near the plant which houses the belt conveyor (11) and which in turn delivers the material to either railway cars (k) or trucks (l).

(k) Roadway siding for receiving material from belt conveyor (11).

(l) Roadway for trucks to receive material from belt conveyor (11).

It will be noted in Fig. 4 that a plant is provided for storing two sizes of gravel and one of sand to one side of the washing plant. To accomplish this the material is spouted from one side of the plant to a storage pile from where it is conveyed by means of a drag scraper, out on to the extended storage piles at any required point. The dimensions and arrangement as shown will permit of providing storage piles about 12 ft. high at a point near the washing plant and 30 ft. high at a point near the outer end. Approximately 15,000 cu. yd. of material can be stored and reclaimed by the method and within the dimensions given in Fig. 4.

Fig. 5. Arrangements in the pit for the scraper excavation

To reclaim this material and deliver it to a point where it can be loaded on cars or trucks the same scraper bucket is used by merely reversing its position and delivering the material back toward the plant over tunnel *j* where it is spouted on to belt conveyor (11) for delivery to cars *k* or trucks *l*. Figs. 6 and 7 illustrate in a general way the storage arrangement when looking from the plant to the outer end.

(9) Beam on which a trolley with cable blocks is attached that can be moved to various positions to pick up the load for storing purposes at any point from one side of the plant.

(10) Scraper bucket illustrated in Fig. 1, which may have its position reversed for either storing or reclaiming.

(11) Belt conveyor previously described for taking the material from under the storage piles and delivering it to cars or trucks.

(12) Power unit and hoist are located at this point in a manner as shown in Fig. 8. The operator is located on an elevated platform so that he may have control and be in a position to see the entire operation and travel of the bucket.

(13) Head post provided with the necessary blocks to receive the cable from the hoist (12) carrier (16) and the trolley or beam (9).

(14) Two masts approximately 50 ft. high between which is strung the cable (18) for supporting the bridle (16).

(15) Double drum hand winch which operates cable (19) for shifting bridle (16) to any desired point at the far end of the storage piles.

(16) Bridle carrier and block over which the cable (17) operates and which can be moved to any point as described before.

(17) For the ordinary application of a drag scraper, the cables only pull in one direction and the one that pulls the bucket forward is termed "pull cable" and the one that returns the bucket empty is the "pull back cable." The "pull back cable" usually operates at a higher speed than the "pull cable" because it does not carry a load of material, in this case, however, the cable (17) is used for both purposes and therefore operates at only one speed.

(18) Cable strung between masts (14) as previously described for supporting bridle carrier (16).

(19) Cable used for shifting bridle carrier (16) to any desired point by means of winch (15).

The writer does not intend to convey by means of this article that this is the best method for using the drag scraper for this

Fig. 8. Hoist and scraper controls in elevator tower

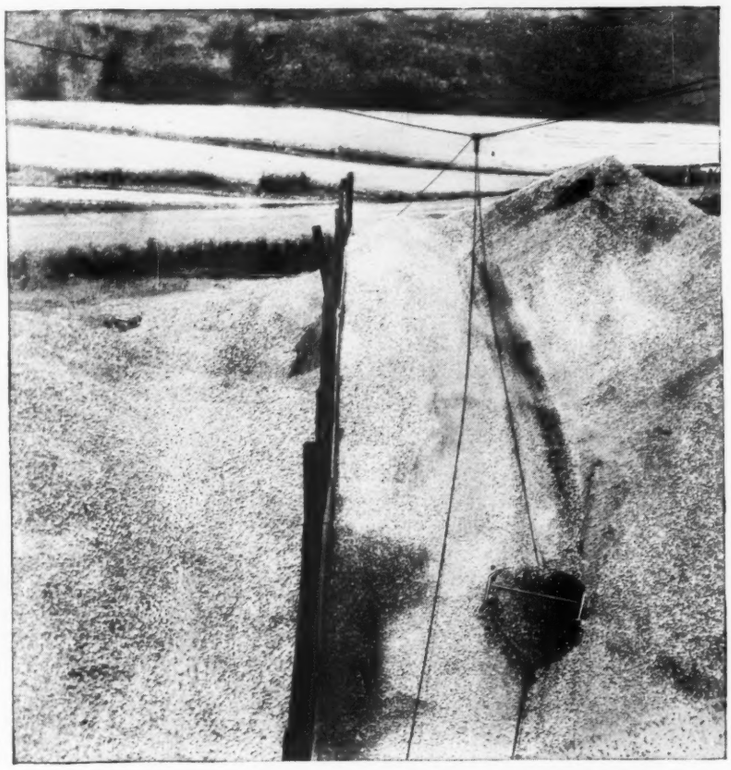


Fig. 6. Storage arrangements as seen from the initial piles from the plant bins

purpose nor that other means cannot be used to obtain similar results, but does intend to illustrate one method of economical storing and reclaiming the finished product of a sand and gravel washing plant, by means of a drag scraper.

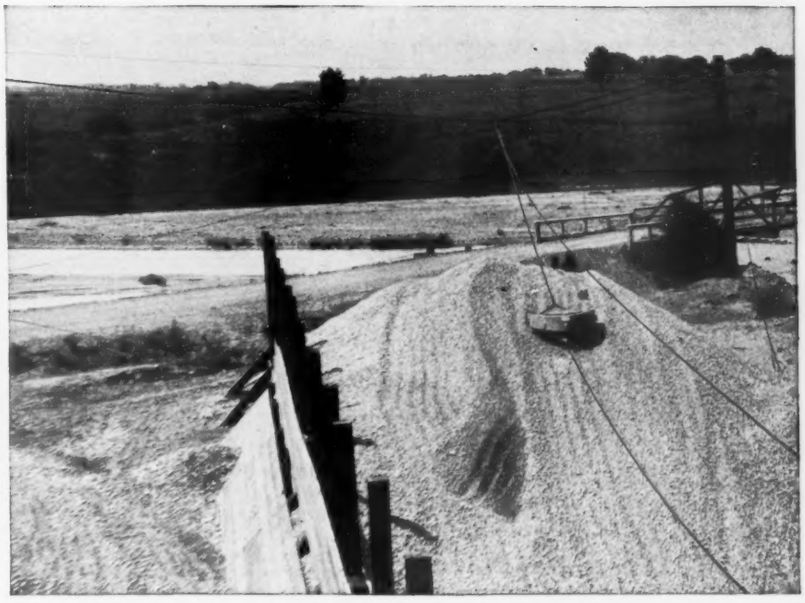


Fig. 7. The scraper carrying material from the piles to storage (See Fig. 6 also)

Cement Reference Laboratory Tolerances

THE CEMENT REFERENCE LABORATORY, established during the last fiscal year as a cooperative effort of Committee C-1 on Cement of the American Society for Testing Materials and the Bureau of Standards, to promote uniformity and improvement in cement testing, has been engaged for several months in field inspection of cement laboratories. The inspectors may not visit some localities for considerable periods of time, and on that account the following tolerances on apparatus should be of interest to those laboratories which desire to examine and adjust their apparatus or write purchase specifications for new apparatus. It should be understood that these tolerances are "proposed tolerances" and have not at this time any official standing as accepted standards or tentative standards of the American Society for Testing Materials. However, the cement reference laboratory is operating under these tolerances.

Proposed Tolerances on Apparatus

1. Insert at the end of section 35 the following:

"The Vicat apparatus shall meet the following requirements:

Weight of plunger, 300 g. (0.661 lb.) ±0.5 g. (±8 g.).

Diameter of larger end of plunger 1 cm. (0.394 in.) ±0.02 mm. (0.001 in.).

Diameter of needle, 1 mm. (0.039 in.) ±00.1 mm. (0.0005 in.).

Inside diameter of ring at bottom, 7 cm. (2.75 in.) ±3 mm. (0.12 in.).

Inside diameter of ring at top, 6 cm. 2.36 in.) ±3 mm. (0.12 in.).

Height of ring, 4 cm. (1.57 in.) ±0.5 mm. (0.02 in.)."

2. Insert at the end of section 45 the following:

"The Gillmore needles shall meet the following requirements:

Initial needle—

Weight, ¼ lb. (113.4 g.) ± 8 grains (0.5 g.).

Diameter, ½ in. (2.11 mm.) ±0.001 in. (0.02 mm.).

Final needle—

Weight, 1 lb. (453.6 g.) ± 8 grains (0.5 g.).

Diameter, 1/24 in. (1.06 mm.) ±0.001 in. (0.02 mm.)."

3. Replace subnote (3) of section 31, note 1, with the following:

"The balance used in making the fineness test shall meet the following requirements: The balance shall be inclosed in a glass case. On balances in use the tolerance to be allowed at a load of 50 g. shall be ±0.05 g., and at loads less than 0.1 g. the tolerance shall be ±0.01 g. (The tolerance to be allowed on new balances shall be one-half of the value given.) The maximum sensibility reciprocal allowable at each of the loads specified above shall be twice the value of the tolerance specified for the load in question. The sensibility reciprocal is a measure of the sensitivity of a balance and is the weight required to move the position of equilibrium of the beam, pan, pointer, or other indicating device of a scale a definite amount at the capacity or at any lesser load.

After subnote (5) insert as follows:

"6. The tolerances to be allowed in excess or deficiency on the weights in use in the fineness test shall be as follows:

Weight	Tolerance	Weight	Tolerance
g.	g.	g.	g.
50	0.04	0.500	0.003
20	.02	.200	.002
10	.014	.100	.001
5	.010	.050	.001
2	.006	.020	.001
1	.004	.010	.001

"The tolerances to be allowed on new weights shall be one-half the values given."

4. Add to section 33 a note to read:

"The scales used in weighing materials for neat cement and mortar mixes shall meet the following requirements: On scales in use the tolerance to be allowed at a load of 1.000 g. shall be ±1.0 g. (The tolerance to be allowed on new scales shall be one-half of the values given.) The sensibility reciprocal (see note 1(3) under Determination of Fineness) shall be not greater than twice the tolerance.

"The tolerances to be allowed in excess or deficiency on the weights in use in weighing materials for neat cement and mortar mixes shall be as follows:

Weight	Tolerance	Weight	Tolerance
g.	g.	g.	g.
1000	0.5	20	0.05
500	.35	10	.04
200	.20	5	.03
100	.15	2	.02
50	.10	1	.01

"The tolerances to be allowed on new weights shall be one-half the values given."

5. Add to section 33 a note to read:

"Glass graduates of 100 to 200 ml. capacities used for measuring the mixing water shall be made to deliver the indicated volume at 20 deg. C. (68 deg. F.). The tolerance to be allowed on these graduates shall be ±1.0 ml."

6. Insert at the end of section 47 the following:

"The dimensions of the briquette molds shall meet the following requirements: Width of mold, between inside faces, at waist line of briquette, 1 in.±0.01 in.; thickness of mold 1 in.±0.004 in. The tolerances to be allowed on new molds shall be one-half the values given."

7. Amend section 52 as follows:

In place of portion commencing in line 3 with "The machine shall be capable . . ." and ending in line 8 with ". . . any lesser load," insert the following:

"The error for loads of not less than 100 lb. shall not exceed ±1.0% for new machines or ±1.5% for used machines."

Also add to the last sentence of this same paragraph—"± 25 lb. per minute."

8. Insert at the end of section 55:

"The relative humidity of the moist closet shall not be less than 90%."

9. Add the following note after section 28:

NOTE.—The balances used in the chemical analyses shall meet the following requirements: Capacity not less than 100 grams in each pan; the two arms of beam to be equal to within 1 part in 100,000; capable of reproducing results within 0.1 mg.; sensibility reciprocal (see note under Determination of Fineness) not more than 0.2 mg. per division of the graduated scale. The weights used in the chemical analysis shall conform to the requirements of the Bureau of Standards specifications for class "S" weights as contained in Bureau of Standards Circular 3.

Federal Trade Commission Acts on Lime Industry Code

Eighteen of the 24 Proposed Rules Accepted—Eleven as Covering Unfair Practices, the Remaining Seven as Expressions of the Trade

THE FEDERAL TRADE COMMISSION announces its action on rules of business practice adopted by the lime industry at a trade practice conference held under commission auspices in Washington last June (see ROCK PRODUCTS, July 6, 1929).

As acted upon by the commission there are 18 rules, 11 having been affirmatively approved as covering unfair methods of competition, the remaining seven accepted as expressions of the trade. At the trade practice conference there were 24 rules adopted.

Rules affirmatively approved relate to such practices as price discrimination; secret rebates; interference with contracts; selling below cost; defamation of a competitor; violation of an Act of Congress entitled "An Act to Standardize Lime Barrels"; selling lime in used barrels bearing the label of a producer or dealer other than the one producing or selling it; deception of customers as to quantity and other conditions; simulation of trade marks, trade names and the like.

Resolutions, or Rules 2, 15, 17 and 19, as adopted, were stricken by the Commission. The "Note by the Industry," accompanying Resolution 7, as adopted, was also stricken. Resolution 16 and the accompanying note, as adopted, was stricken out, and in lieu thereof the Commission substituted Rule 14 as appears herein. The note accompanying former Resolution 9, as adopted, reciting "An Act to Standardize Lime Barrels," is transferred to the close of the report, and appears as an exhibit. Resolutions 23 and 24, creating and dealing with a committee of the industry, were not accepted by the Commission, being inappropriate as trade practice conference rules. The Commission, however, has no objections to the industry's having such a committee, and the resolutions appear as an exhibit.

[Rule 2, which was stricken out by the Commission, dealt with adherence to published prices. Rule 15, referred to inducing sales by other products, or camouflaged price cutting. Rule 17 was the provision against "dumping" in territories remote from the producer's customary market territory. Rule 19 was designed to prevent "transit shipments" without a specific order from a customer. The omission of these four rules materially weakens the code, for they struck at the very heart of practices which are in a large measure responsible for the condition of the lime industry.—The Editor.]

The remaining resolutions, after amendment in some instances, were accepted by the Commission and become the rules of business conduct on the subjects covered. Those appearing in Group I, having been held by the Commission to condemn unfair methods of competition, are affirmatively approved, and those appearing under Group II are accepted as expressions of the trade.

GROUP I—RULES

RULE 1. To discriminate in the prices charged to different customers of the same class for industry products; provided that this shall not prevent price discrimination necessarily resulting from differences in the grade, quality, or quantity of the commodity sold, or that makes only due allowance for necessary differences in the cost of selling or transportation, or discrimination in the same or different communities made in good faith to meet competition, is an unfair trade practice.

RULE 2 (formerly Resolution 4). To secretly allow to purchasers of industry products, whether dealers or consumers, commissions, bonuses, rebates, refunds, credits, unearned discounts, or subsidies of any kind, whether in the form of money, services, advertising, or otherwise, or give premiums, or extend to certain purchasers special terms, services or privileges not extended to all purchasers under like terms and conditions, amounting to discrimination, is an unfair trade practice.

RULE 3 (formerly Resolution 6). To wilfully interfere with any existing contract between any other manufacturer and a wholesaler, retailer, consumer or other party, involving or relating to the sale of industry products, such interference being for the purpose or with the effect of dissipating, destroying or appropriating, in whole or in part, the business represented by such contract, is an unfair trade practice.

RULE 4 (formerly Resolution 7). To sell industry products below cost for the purpose of injuring a competitor and/or lessening competition, is an unfair trade practice.

RULE 5 (formerly Resolution 8). To defame or disparage a competitor, directly or indirectly, by words or acts which untruthfully call in question his business integrity, his ability to perform his contracts, his credit standing, or the quality of his product, is an unfair trade practice.

RULE 6 (formerly Resolution 9). To violate the provisions of the Act of Congress approved August 23, 1916, Pub. No. 228, 64th Congress, entitled "An Act to Standardize Lime Barrels" in all transactions, is an unfair trade practice. (See U. S. Code, Vol. 44, Part I, of the U. S. Statutes at Large, Title 15, Chap. 6, Sections 237-242, inclusive.)

(NOTE: The statute referred to in Rule 6 above is reproduced as an exhibit.)

RULE 7 (formerly Resolution 10). To sell lime or permit it to be sold in used barrels bearing the brand, label or name of a producer or dealer other than the one producing or selling the product contained therein, where the purpose or effect may be to mislead or deceive the purchaser as to the source of production, grade, quality or quantity of such product, is an unfair trade practice.

RULE 8 (formerly Resolution 11). To sell or offer for sale any industry product for the purpose of or with the effect of deceiving customers or prospective customers as to the quantity, quality, or grade of such product, is an unfair trade practice.

RULE 9 (formerly Resolution 12). To imitate or to simulate the trade mark, trade name, package, brand or label of a competitor in such degree as to deceive or have a tendency to deceive customers, is an unfair trade practice.

RULE 10 (formerly Resolution 13). Marking, branding and labeling products and making statements regarding products, the purpose or effect of which may mislead or deceive purchasers as to the quantity, quality, grade or substance of the goods purchased, is an unfair trade practice.

RULE 11 (formerly Resolution 5). To secretly give or permit to be given to the agents, employes or representatives of customers, or the agents, employes or representatives of competitors' customers or prospective customers, money or anything of value as inducement to cause their employers or principals to purchase or contract to purchase industry products, or to influence such employers or principals to refrain from dealing or contracting to deal with competitors, is an unfair trade practice.

GROUP II—TRADE PRACTICE RECOMMENDATIONS.

RULE 12 (formerly Resolution 3). To put into effect changes in the established marketing customs and usages of the industry calculated to impair confidence or destroy stability in the industry without such reasonable notice as will enable the industry to meet such innovations on a basis of fair and open competition, is condemned by the industry.

RULE 13 (formerly Resolution 14). To deviate from the established practices of the industry as regards the grade, quality or substance of standard industry products, or the size of packages or containers for such standard products, is condemned by the industry.

RULE 14 (substitute in lieu of Resolution 16). It is the judgment of this industry that an accurate knowledge of costs is indispensable to intelligent and fair competition, and the general adoption of accurate and uniform methods of cost finding and estimating is strongly recommended.

RULE 15 (formerly Resolution 18). To ship lime or lime products on consignment is condemned by the industry.

RULE 16 (formerly Resolution 20). *Resolved*: That lime manufacturers who sell their products through brokers, jobbers and distributors, wholly or in part, shall use their best effort to bring about the observance of these rules of approved practice by such brokers, jobbers and distributors.

RULE 17 (formerly Resolution 21). A jobber or distributor shall be defined as any person, firm or corporation who is engaged in the business of selling lime or lime products, either exclusively or with other materials, but is not engaged in the manufacture of the particular type or class of lime products, and who sells the materials to another person, or to another firm or corporation in which he is not financially interested, for the purpose of resale, and who carries the account and is responsible for the credit risk of the shipment.

RULE 18 (formerly Resolution 22). The Trade Relations Committee of the National Lime Association is hereby constituted the source within the industry from which manufacturers may secure information relating to the Trade Practice Conference and all rules adopted thereby.

Use of Fuel in the Manufacture of Portland Cement*

By H. P. Reid
Special Engineer, Universal Portland Cement Co., Chicago, Ill.

THE uses of heat in the manufacture of portland cement can be classified as for (1) drying, (2) burning, and (3) power. For the generation of this heat fuel is required. In some cases separate fires are maintained for each of these three requirements, while under other conditions power is generated from the waste heat in the gases leaving the kiln. Generally speaking, of the fuel used for drying and burning, 10 to 25% is required for the former and 75 to 90% for the latter. In all dry-process plants and in many of those of the wet process, sufficient heat may be reclaimed from the waste kiln gases to generate the necessary power required to operate the mechanical equipment. As this power is generated from heat produced by fuel burned in the kiln, it is proper to credit the "burning" with the fuel equivalent of the power generated. Such an adjustment would charge the power with from 25 to 35% of the total plant fuel, "burning" with 45 to 60%, and drying as given. These percentages are to be considered as representative of the cement industry as a whole, and not necessarily actual for any definite plant.

Types of Fuel

Natural gas, producer gas, blast-furnace gas, oil and pulverized bituminous coal are usable as fuel in the portland cement industry. According to a bulletin of the U. S. Bureau of Mines, recently published, of the cement produced in 1927 in this country, over 80% was from plants using coal as fuel. The selection of the kind of fuel is made on the basis of cost of heat units delivered at the burner. It is therefore logical to expect to find oil and natural gas used in such places as are distant from suitable coal supply but near the oil and gas wells. Blast-furnace gas is used where the cement mill is operated in connection with blast furnaces, and a surplus of gas is available. Referring again to the same bulletin of the Bureau of Mines, the average fuel consumption in 1927, per barrel of cement produced with the various fuels, was with coal 135.8 lb., with oil 0.2743 bbl., and with natural gas 2450.5 cu. ft.

Practically any bituminous coal when prepared properly can be used as fuel in the cement kiln. Bin systems rather than unit mills are commonly used, and therefore the coal is usually dried before pulverizing. There are, however, a number of unit mills successfully operating at installations made in the past few years.

Uniformity in Pulverized Coal Essential

The cement kiln considered as a furnace is radically different from the pulverized-coal fired boiler furnace, and because of this difference it has been found necessary to pulverize the coal finer than is the usual power-plant practice. Uniformity of fineness is essential, and the kiln must have reasonable guarantees against shutdown, even for short periods, to insure uniform quality of the product, and to preserve the life of the refractory lining. To insure even fires the coal as fired should be of nearly uniform moisture content, which condition is somewhat difficult to maintain in winter when snow and ice often exist in the coal as received. The given requirements account largely for the installations of the bin system in the majority of the cement plants. On the other hand, the development of the modern unit pulverizer with its air separator to control the fineness, with the use of preheated air in the mill to absorb moisture from the coal, and the improvements in design and selection of materials of construction to reduce operating delays will undoubtedly result in greater use of this type to mill by this industry.

Coal Drying Problems

When using the bin system the moisture in the coal must be reduced to such an amount as will permit economical pulverizing mill operation, and such that the prepared coal may be conveyed to the bins and be drawn from them without blocking. The permissible amount of moisture depends largely on the character of the coal and no the type of mills, transport system, and burner feeders. Where air separation is used for fineness control considerable moisture may be removed by the mill air. Especially is this true when the coal fed to the mills has been preheated by partial drying or when the quality of air vented from the system is large. Additional mill drying may be accomplished by introducing preheated air to replace that vented from the system. A small amount of moisture is removed from the coal in the screen type of mill, but usually the air circulation through such mills is insufficient to carry away much moisture. There is, however, the problem of recovery of the fine coal from mill-vent air, and also that of maintaining the temperature of this vented air high enough above its dew point to keep the ducts clean, and to remove fire hazards from such ducts.

It is customary in the cement industry to dry Pittsburgh and West Virginia coals down to 1 or 2% moisture as they leave the mills, and Illinois, Indiana and Kentucky coals to from 2 to 4%. These percentages are often more a matter of practice than absolute necessity, as it is much more economical to take care of the moisture of the coal in the kiln than to remove it in dryers, provided that this moisture is low enough to permit uniform feeding, and such as will not make it difficult to hold the kiln fires.

Safety in the Coal Mill

Precautions and good housekeeping are essential in the coal preparation buildings of these plants to insure safety as they are in similar buildings of other industries. There is, however, a coal fire hazard peculiar to the type of machines used in cement plants. The discharge end of the cement kiln, where the fuel is admitted and ignited, is open except for a shielding hood. As this hood is stationary and as the kiln rotates, there is of necessity an opening between the two. In some cases this opening is closed by a rotating seal, but more often it is not. Furthermore, openings are necessary for the admission of secondary combustion air, and for the burnerman to watch his kiln operation. In starting up a cold kiln the coal is liable to burn very irregularly until the kiln walls become sufficiently heated to hold the fire; also irregularities in the coal feeders may result in more or less violent explosions within the kiln. While the force of such explosions is largely dissipated within the kiln, yet ignited fuel and hot gases are forced out of these openings, and may be dangerous for some distance from the kiln end. Pulsations in the flame are quite common in rotating kilns. These may be caused by irregular discharge of coal from the feeder, by too high a percentage of primary air, or by too strong a draft.

High ash content in the coal is probably less troublesome in the operation of a cement kiln than in most other industries. Generally speaking high ash indicates relatively low B.t.u. content, and ash purchased as coal is

*Presened at the Third National Fuels Meeting of the American Society of Mechanical Engineers at Philadelphia, Penn., October 7 to 10, 1929.

expensive cement raw material. As high percentages of silica and alumina are found in portland cement, the ash of the coal may be absorbed by the clinker in the kiln. The chemist in his control must, however, consider this ash as its weight amounts to approximately a quarter of a per cent of the clinker weight for each per cent of ash in the coal.

Drying Processes Used

The dry and the wet processes are both widely used in this country for the manufacture of portland cement. Both processes have, in general, similar operating problems. In the dry process the moisture is driven from the raw materials before they are ground, while with the wet process more water is added, and the materials are ground in a slurry form. This slurry is pumped or conveyed to the kiln feeder. In some cases part of the moisture is filtered out before entering the kiln, while in other cases all is fed to the kiln. Whatever moisture there may be in the kiln feed must be evaporated in the back end of the kiln by the hot gases.

With the dry process it is the usual practice to pass each of the raw materials through its separate rotary dryer. Such dryers are cylindrical tubes made from steel plates, mounted on two concentric steel tires, and rotated about their longitudinal axis. To effect material travel through these tubes they are usually pitched ¼ in. to ¾ in. per foot of horizontal length. Some dryers have no pitch but depend on the construction of internal lifters or flights to effect the forward travel of the material.

Heat as applied to the drying material is obtained by burning fuel either in furnaces in front of the dryers or in air suspension within the dryers. It is difficult to obtain efficient combustion, and at the same time large output with these machines. If a furnace is used in order to effect complete combustion of the fuel before the gases enter the dryer, the heat transfer from the gases to the material and the moisture therein, must be largely by convection rather than radiation. Such transfer requires large drying surfaces, which results in very large units in order to obtain capacity. If, on the other hand, the fuel is burned in suspension, the cold dryer walls and the heavy concentration in the dryer atmosphere of fine material particles so chill the flame as to quench many burning fuel particles. Consequently, combustion is not completed and losses by unburned fuel run high. In order to hold a fire at all with such a system, ignition is effected in a small refractory lined chamber whose walls are held at an incandescent heat. However, with such a flame properly directed over the material large amounts of heat are transferred to the material by radiation, and the output of such a machine is generally greater than it would be were a furnace used.

Dryers with Ignition Chambers

Some dryer manufacturers build a small furnace before the dryer for use with powdered coal or oil. Such a furnace is little more than a large ignition chamber for the fuel. By the time the blast of air and fuel has passed through the furnace, the fuel is well ignited and partially burned, combustion continuing in the front end of the dryer. With the use of such a furnace better combustion is obtained, and considerable radiant heat transfer occurs also. Fuel savings should be expected as compared with burning entirely inside the dryer, and at the same time the capacity should be greater than is possible with a furnace for complete combustion.

Some raw materials have low moisture content, and are of such a nature that this moisture is readily driven off. With such the drying problem and the dryer efficiency is of relatively small importance. Other raw materials contain high moisture or are of such nature that the moisture is difficult to remove. With the latter the efficiency with which the fuel is burned may reflect heavily on the production costs.

Improving Dryers in Use

At many of the older plants, most of which are dry process, the cost of fuel was so low when they were built that combustion efficiency was then of small importance. In the construction of such plants the dryers were usually so bound in by other mill machinery that there is not sufficient space now to rebuild with machines that would be more economical in the use of fuel.

The application of heat at high temperatures in amounts sufficient only to evaporate theoretically the moisture will not effect complete drying in most raw-material dryers. Such application of heat would result in the gases leaving the dryer not only saturated with moisture but also carrying considerable superheated steam over and above the moisture absorbed by the gases. Consequently, excess air must be added, usually in very large percentages, to the combustion gases to provide sufficient moisture carrying vehicle. From the thermal viewpoint, such a dryer is of necessity quite inefficient. As has been pointed out, good combustion is difficult, heat losses in the stack gases are great due to the large volume of drying vehicle necessary, and as the material must be heated up in order to evaporate the moisture, considerable heat is carried away by the dried material. Much work has been done in efforts to improve the thermal efficiency of these machines, yet it can be appreciated that for this type of work such a machine can not be made highly efficient from the thermal viewpoint. If heat otherwise lost around the kiln could be reclaimed and used for this drying considerable economies might be effected.

The prepared material, wet or dry, is fed into the back or high end of the kiln, and is moved forward by the rotation and pitch of the kiln. For this pitch ¼ in. to ¾ in. per foot of horizontal length is used. The speed at which the kiln is rotated varies widely, some kilns running as fast at 2 r.p.m. while others maks but 1 revolution in 2½ to 3 minutes. It can therefore be appreciated that the time required for material to pass through the kiln is a factor of length, pitch, diameter, and rotary speed.

Fuel in blast suspension is admitted at the front end of the kiln, and the combustion gases travel against the forward moving feed. Both the surface of the feed and the exposing lining of the kiln absorb heat from the flame and the gases. While a small amount of the heat absorbed by the refractory lining travels through the bricks and is radiated from the outer shell, most of it is transferred to the feed as the kiln rotates.

With the wet process the moisture in the slurry or in the filtered feed is evaporated in the back end of the kiln. In some kilns this back end is an open tube similar to the rest of the kiln except that metal rather than refractory lining is used. With other kilns various devices are employed to facilitate evaporation. These devices in general use some system designed to increase the area of surface exposed to the gases. One such device employs a large number of chains so fastened to the kiln shell that they drop in loops from that portion of the shell above the kiln center, and lay on the shell below that center. The hanging loops present large metallic areas to the gases, and thus absorb heat from the latter. As the kiln rotates and the wet feed rolls over these chains, the moisture and material absorb the stored heat, and leave the chain surfaces wet as they again come in contact with the gases.

Reaction Temperatures in the Kiln

From the time the moisture is evaporated in the wet-process kiln the two processes are similar. The dry feed is gradually heated to higher and higher temperatures as contact is made with hotter and hotter gases as it travels forward until the carbonates of calcium and magnesium begin to break down, and the sulphur and organic matters ignite and burn. This calcination of lime and magnesium begins at temperatures of about 1500 deg. F., and is completed by the time the material has reached 1750 or 1800 deg. F. In completing this process an average of about 950 B.t.u. per lb. of clinker produced is absorbed by the material. There are wide variations from this average depending on the composition of the raw materials used. The material then enters a second stage of heating until its temperature is raised to approximately 2600 deg. F. As the higher temperatures are approached the calcium, silica and alumina regroup themselves into complicated chemical structures. The exact temperature necessary for the foregoing reactions will depend on the fineness of the

particles of material, their proportions in the mix, and also quite possibly upon the presence in small amounts of other metals. The time required for the transaction has not been determined to the satisfaction of the average operator. It is the general belief that safety for quality lies in a relatively long zone in the kiln where these higher temperatures are maintained. Forward from this hot zone there are several feet where the clinker, formed by incipient fusion of the materials under the high heat, gives off some of its heat to the incoming combustion air and fuel.

Clinker Cooling

Clinker leaving the kiln will be from 1800 to 2200 deg. F. according to the length of this cooling zone, which varies widely in the same size kilns at different plants, and to some extent on the same kiln according to the temperature of the air entering and to the amount of draft used.

In many of the older plants the clinker as it leaves the kiln is sprayed with water to cool it sufficiently to permit the use of metallic conveyors or elevators for removing it to cooling or storage piles. Further cooling may be effected by water spray, by exposure to air, or by a combination of the two.

In plants of more recent design, mechanical coolers are used. The most popular type of these clinker coolers appears to be a rotating cylindrical shell through which atmospheric air is blown against the clinker travel. Such quantities of the air heated in cooling the clinker as are required for combustion are delivered into the kiln. Some of the air may be passed through the coal mills to assist in removing the moisture when unit mills are used. There yet remains a large volume of air containing considerable heat which must be wasted. Such air would be of value in drying coal and raw materials were it possible to transport it to the dryers without too great a heat loss.

Combustion Processes Within the Kiln

In describing the combustion within the kiln, pulverized coal will be considered as the fuel; such description can be applied readily to other fuels by those interested in them.

The pulverized coal is blown into the kiln with blast or primary combustion air at such a velocity as to insure its being carried by the gas streams until combustion has been completed. This velocity may vary according to the open inside diameter of the kiln, the fineness of the coal and the draft used. While many attempts have been made to use improved burners which would mix the coal and air intimately, and produce gas turbulence for scrubbing the films from the burning particles, most such efforts have not proved a success, and the open pipe is almost exclusively used as a burner with the rotary kiln.

Rate of Heat Transfer

The fuel is ignited, combustion takes place and the gases deliver their heat to the material all within a straight, nearly horizontal rotating tube, and the burning fuel cannot be allowed to impinge on the refractory. Therefore, the time required for complete combustion of a given size particle must be much longer than would be necessary were turbulence of the gas stream possible. It is practically impossible to maintain refractories with their surfaces directly exposed to the high temperatures of the flame, and at the same time to the erosive action of the clinkering materials rolling over these surfaces. No attempt is made to burn on the exposed lining, but it is coated in the hotter zones by material fused to it. As the material mass traveling through the kiln is heated to a state of incipient fusion it will adhere readily to surfaces which are slightly cooler than it. To enable the refractory to present and maintain this cooler surface to the semi-fused material, heat transfer must take place outward through the refractory to the shell and atmosphere. The rate of this transfer is governed largely by the thickness and nature of the refractory. If too thick the heat flow is too slow, and the face of the refractory will burn away until the heat equilibrium is established, and the protecting coating fuses to it. If at any subsequent time the fire becomes too intense or localized, this coating will be melted away. The ease with which such a coating may be formed and held is largely a function of the raw materials used for the cement, and also of the skill of the burnerman.

Temperature Control

Sufficient heat must be generated to raise the temperature of the material to, and maintain it at approximately 2600 deg. F. As the chemical reactions take place a small amount of heat of reaction is liberated at the higher temperatures. The temperatures in this hot zone must be held within the limit of the life of the fused coating or the refractory will be ruined in a few hours. Normally such a refractory lining should last from nine months to two years.

With turbulent or short-flame burners there is not sufficient radiant heat absorbing material around their short combustion zone to cool the flame to safe temperatures. With the open-pipe burners, because of the lack of turbulence, the combustion is sufficiently slow to permit enough heat transfer to keep the temperature of the flame within safe limits. Also this slow-burning flame may be made so long that a safe length of clinkering zone can be maintained readily for the proper chemical reactions. The length and position of the flame with a given installation may be altered over a wide range by the fineness of coal pulverization, by percentage and temperatures of primary air, by temperature of secondary air, and by the draft on the kiln. The operator usually has control of the rate of coal feed, the volume of primary air, and the draft.

Very wide ranges of the percentages of primary-combustion air are used in the industry. Some installations use as little as 20% while others use more than 50%. Generally speaking, high percentages of primary-combustion air tend toward short flame and short refractory life. The permissible percentages of this primary air depend largely upon the characteristics of the coal used.

Preheating of Combustion Air

While preheating of the primary and secondary air can be used with economy in many installations, it should be introduced with care on existing equipment as it tends likewise to shorten the flame and thus create excessive zone temperatures. Because the fuel must be burned in suspension in a long horizontal gas stream, the necessity of fine pulverization of the coal is evident. The exact value of a coal particle which drops out of the gas stream into the material traveling through the kiln is unknown. However, as the heat requirements of the kiln are the maintenance of certain temperatures, it may be that the B.t.u. of such coal particles are not as effective as when they are dissipated at higher temperatures found in the flame. Certainly delayed combustion of coal particles which remain in the gas stream is undesirable, as under such conditions their heat is liberated in that portion of the kiln where an excess amount of heat already exists.

"Balling" of Coal Particles

Balling of the pulverized coal particles is probably much more prevalent with the bin system than is commonly appreciated. After having expended power to grind the coal to a given fineness, more attention should be given to the conveying and mixing equipment to see that the full advantages of the fine grinding are obtained, and not largely counteracted by feeding the coal to the burner in lumps or balls. Uniformly mixing this fine coal with the primary air should also be accomplished. It may be possible that by using proper precautions against balling, by maintaining proper air and coal mix, and then with the use of preheated air obtained from the clinker, economies might be obtained in coal preparation, as these features should overcome to a certain extent the drawbacks of coarser coal and higher moisture content.

Care of Refractory Linings

Heat insulating materials can be used between the refractory lining and the steel shell in that portion of the kiln from the feed end forward to within a few feet of the clinkering zone. However, there are no refractories economically available that would

stand the clinkering zone temperatures were heat insulating materials placed behind them. As the refractories are held in place within the steel shell solely by the arch action of the complete circle, insulation must be placed with extreme care behind the brick of this circle. To reduce relative motion between the brick and insulation, and to minimize the crushing effect of the load on the insulation, key brick are placed against the shell at frequent intervals.

Fuel Ratios

While different brands of portland cement may vary in calcium and magnesium content depending upon the raw materials used, a cement having a CaO equivalent of 65% and a MgO equivalent of 2¼% may be said to be representative. Assuming that all this lime and magnesium existed in the raw materials as carbonates there would be about 195 lb. of CO_2 liberated in calcining sufficient of their materials for one barrel of cement. For burning such a cement approximately 100 lb. of coal would be used in the kiln with the dry process. This coal should produce about 275 lb. of CO_2, making a total of 470 lb. of CO_2 per barrel of clinker produced or 4.7 lb. of CO_2 per pound of coal burned. Because of the slight turbulence in the gas stream as it flows, it is difficult to maintain 0% CO with less than 2% of O_2 in the gases leaving the kiln. To insure proper oxidation of the undesirables in the kiln feed, this amount of O_2 which corresponds roughly to 11% excess air is probably necessary. However, to maintain a definite percentage of CO_2 as indicated from the foregoing is impossible with many raw materials because the lime is not always in the form of carbonates, but may exist as other calcium compounds, thus varying the amount of CO_2 evolved. Also the quantity of coal burned per barrel of clinker is not constant, and very slight changes in the draft radically change the amount of induced air at the front end. Again, the thickness of the coating on the refractory and consequently the free-gas area is variable, thus altering the resistance to gas flow through the kiln. It is therefore evident that a constant draft on the kiln will not result in uniform operation.

Control meters on the gas content, whether CO_2 or CO, have not proved a definite aid in control of the kiln. Pyrometers and draft gages when properly located and interpreted may give some valuable information to the operator. However, because of the adhesive properties of the fine particles in the gases, all such instruments require considerable attention to function properly.

Waste Heat Power Generation

The temperature of the gases leaving a dry-process kiln will be from 1000 to 1700 deg. F., depending largely on the length of the kiln; 1400 deg. F. seems to be accepted as a fair average temperature. With the wet kiln this temperature is much lower, being anywhere from 550 to 1100 deg. F. The longer the kiln of either type the greater the heat transfer to the feed, and consequently the lower the exit-gas temperatures. With the modern type of kilns one would expect exit temperatures of around 1000 deg. F. from a dry kiln, and 500 deg. F. from a wet kiln.

With the average dry process kiln there is recoverable heat in these exit gases sufficient to generate power to operate the entire plant, and in some instances to generate a surplus for other purposes. With the modern wet process kiln the amount of heat possible to recover from the waste gases may be so small that waste heat boilers would not give sufficient return on the necessary investment to justify their installation.

Allowed to Use Term "Gypsum Lumber"

SALE OF GYPSUM building materials as lumber was ordered stopped by the Federal Trade Commission according to an announcement issued October 25 by the commission.

The announcement follows in full text:

"Gypsum building materials made to be used in place of lumber are not lumber as the term is understood in the trade, according to findings of the commission in the case of the Rockwood Corp., of St. Louis, Mo.

"The corporation, manufacturing gypsum building materials, is ordered to cease and desist from—

"Using the word 'lumber' and/or the words 'Rockwood Lumber' in catalogues, pamphlets or advertising matter used in the offering for sale in interstate commerce of gypsum, products or gypsum building materials unless and until the word 'lumber' and/or the words 'Rockwood Lumber' are qualified by the use of the word 'gypsum' or some other word or words equally explanatory in lettering equally as conspicous as the word 'lumber.'

"The building material manufactured by the Rockwood Corp. consisted of from 1% to 2% by weight of cottonwood fiber and about 80% by weight of calcined gypsum (calcium sulphate). The remainder was water of crystallization.

"These materials have the contour shape of lumber and are put in place with carpenters' tools to take the place of lumber, although their appearance, weight and texture are not similar to those qualities in lumber.

"The Department of Commerce in its 'Simplified Practice Recommendation No. 16,' pursuant to the action of conferences held by representatives of the lumber producing and distributing industry, issued the following definition:

"Lumber is the product of the saw and planing mill, not further manufactured than by sawing, resawing, passing lengthwise through a standard planing mill, crosscut to length and matched.

"The respondent's use of the word 'lumber' was held by the commission as having the tendency to deceive the public into the belief that the company's products were actually cut from trees.

New England's 1930 Outlook Is Bright

PREDICTING business activity for the final quarter of 1929, the New England Shippers' Advisory Board estimates an increase in 34 of the 46 main branches of industry over the same period of 1928. The average of this increase is set at 5.6% for the entire group, though in individual industries it is considerably higher.

Cement shipments, for example, are expected to be some 40% above the 1928 level; lime and plaster should increase by 25%, and metals—including brass, bronze, and scrap—from 15 to 25%.—*New York* (N. Y.) *World.*

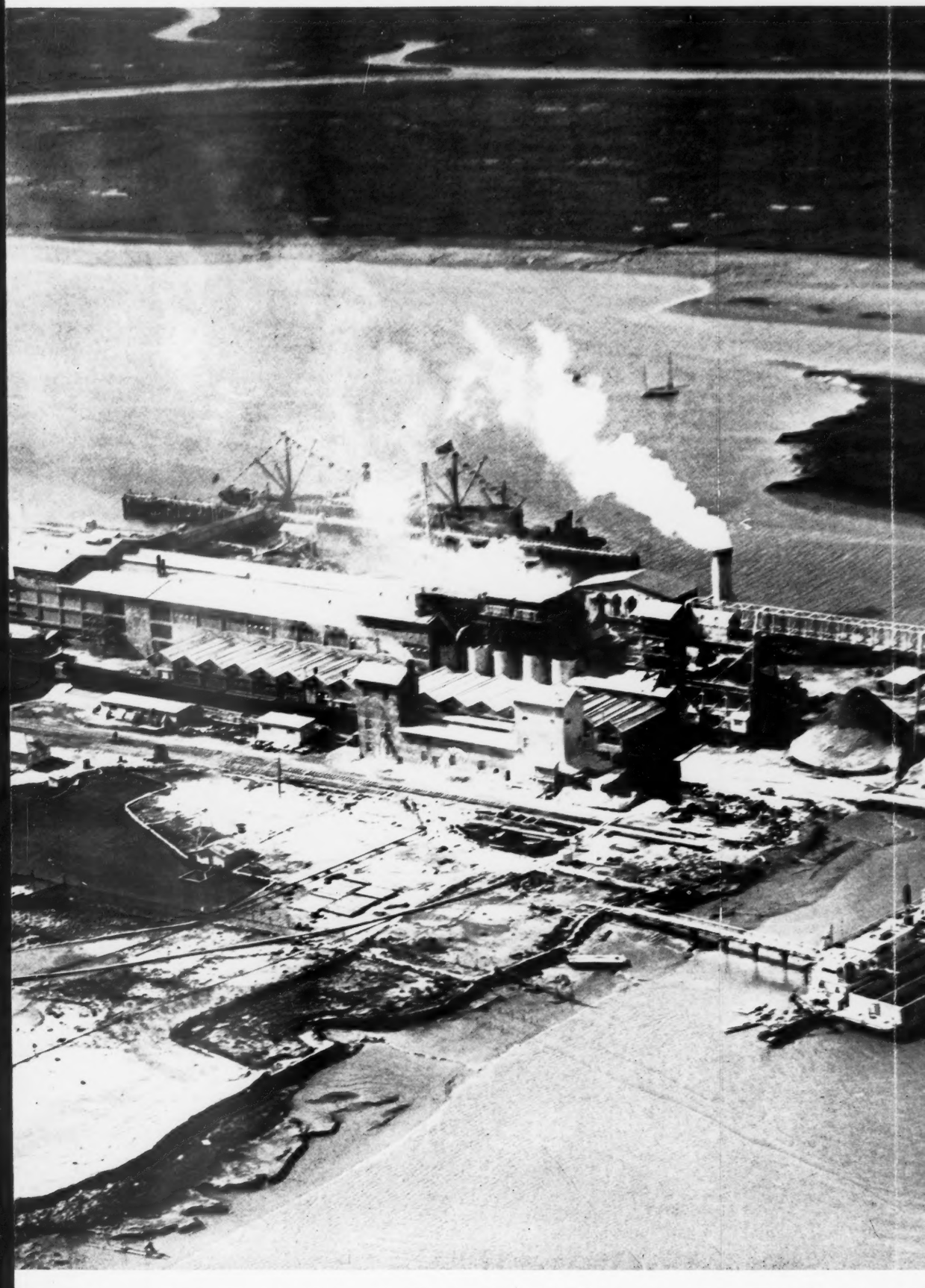
Redwood City Plant of the Pacific Portland Cement Co.

THE airplane view shows the Redwood City, Calif., plant of the Pacific Portland Cement Co., Consolidated, as it now appears after extensive additions were made to the mill in 1927. Built in 1924, the plant was considered one of the best of its time in the United States. and quite unique in its manufacturing processes. Oyster shells dredged from extensive deposits in San Francisco Bay, together with silt and clay washed down from the neighboring hills, are the raw cement materials.

The initial capacity of the plant was 2500 bbl. per day, but in 1927 the second section of the mill, raising the capacity to 5000 bbl. daily, was completed, together with plants for the manufacture of agricultural lime and ground shell. Now four rotary kilns, 250 ft. by 10 ft. dia., are in operation. The original plant was described in ROCK PRODUCTS, November 29, 1924, and a supplemental article detailing signal operation improvements appeared in ROCK PRODUCTS May 11, 1926.

The entire plant is of concrete and steel, constructed on concrete slabs poured on piles driven from 80 to 85 ft. into the ground, and is supposedly earthquake and shockproof. Transportation is by land and water, the company having its own deep-water dock with facilities for handling coastwise and trans-Pacific boats in Redwood Channel.

Airplane view of the Redwood City, Calif., plant, Pacific Portland Cement Co., Consolidated. This shows the recent improvements in plan
crane unloads the oyster shells to the ground storage. In the rear is the deep



s shows the recent improvements in plant and facilities by which production was increased to 5000 bbl. per day. Th
e ground storage. In the rear is the deep water dock where coastwise steamers are loaded with finished cement

per day. The barges are alongside the dock at which the bridge ent

Cement Mill to Be Built at San Diego

A RECENT announcement in the *San Diego* (Calif.) *Tribune* states that the Columbia Cement Co. has formulated plans for the construction of a $2,000,000 wet-process cement mill at San Diego, Calif. The initial capacity of the plant is to be 3000 bbl. daily, production to begin in about eight months or so.

The plant site is located between the tracks of the San Diego and Arizona railway and the Santa Fe in National City. The holdings extend to tidewater and a bulkhead and pier are to be built indicating that the new company will include outside markets in its distribution plans.

Extensive holdings of raw cement materials are said to have been acquired in the vicinity of Coyote Wells, where 7000 acres of suitable limestone deposits are controlled.

Officers of the Columbia company include Fred A. Ballin, former head of the Monolith Portland Cement Co. of California; T. R. Larson, who for 25 years was engaged in the manufacture and distribution of cement and until recently was assistant to the president of the Monolith company; J. Fred Larson, for 20 years an importer and exporter on this coast; J. L. Jennings, former president of the Marine Iron Works, and Judge Arthur Langguth, former shipbuilding executive.

Tulsa Cement Mill Project to Be Surveyed

ACCORDING to C. L. Dewey, industrial commissioner of the Tulsa chamber of commerce, a decision has been reached to employ a representative of F. L. Smidth and Co., internationally known cement mill engineers, to conduct a survey to be used as a basis for going ahead with plans for organizing a company and placing a cement mill at Tulsa, Okla., in operation.

This survey will supplement one already made by the Zenith Limestone Co., which showed that the quantity and quality of material available from its Lost City quarry would be sufficient to justify the establishment of a cement mill.

Negotiations, it is said, are being conducted with the Zenith Limestone Co., operators of a rock quarry at Lost City. This company proposes to establish the mill below the Lost City bluff, where a certain amount of trackage is already available, and to use the spall, or screenings from the rock that is quarried, in the manufacture of the portland cement.

Quarrying operations of past years at Lost City already have resulted in the accumulation of a large amount of spalls, which can be depended on to keep the plant in operation for a considerable period, and quarrying is expected to be carried on in the future to an extent capable of keeping the mill constantly supplied.

It is planned, if the project goes through, to salvage part of the machinery and equipment formerly used by a cement mill at Hartshorne, Okla., in which a number of Tulsans were interested, but which was forced to suspend operation on account of the high cost of mining the rock instead of quarrying it.

Only equipment that meets the most up-to-date standards of cement mill operation will be taken from the Hartshorne plant, the report states.

The plan of financing under consideration is for the issuance of $500,000 worth of common stock to the Zenith interests in return for their contract to operate the mill, a portion of which also would be used to meet the expense of purchasing the Hartshorne equipment.

In addition, preferred, votable stock to the amount of $800,000 would be issued, with the agreement that half should be sold to Tulsans who may be interested in the project, the other half to be disposed of on an eastern market.

It is estimated that eight or nine months would be required to complete the preliminary engineering survey by the Smidth company, and that following this approximately a year would be necessary to erect the plant and get it in operation. The survey is to begin at once.—*Tulsa* (Okla.) *Tribune.*

Haden Plant Manufacturing Lime from Oyster Shells

ANNOUNCEMENT was made by C. R. Haden of Houston, president of the Haden Lime Co., of the completion and placing in operation of the company's new lime manufacturing plant, situated on the Houston, Tex., ship channel. The plant has the distinction of being the only one of its kind in the United States that uses oyster shells exclusively in the making of lime. The new industry represents a capital investment of upwards of $500,000, according to Mr. Haden.

The oyster shells are taken from a deposit adjacent to Houston and transferred over the ship channel to the plant, where after being washed to remove the mud and silt, they are burned in gas-fired rotary kilns.

West Penn Cement Company Increasing Capacity

ADDITIONS to the West Winfield, Penn., cement mill of the West Penn Cement Co. are under way and expected to be completed by January, 1930. The improvements, costing about $160,000, will increase the capacity to about double, according to the *Pittsburgh* (Penn.) *Press.*

The Macdonald-Spencer Engineering Co., New York, are doing the necessary construction work.

Atlas Portland Buys Site in Cuba for Plant

PURCHASE of land in the vicinity of Havana, Cuba, has been completed by the Atlas Portland Cement Co., according to recent announcement. The company is considering erection of a plant for the manufacture of cement. It is understood that if the output of the new plant is successfully placed, the company also will consider erection of another mill on the other side of the island. There is already one American-owned portland cement plant on the island, about 40 miles from Havana, but officials of the Atlas company say they believe the future of Cuba justifies additional modern plants.

Mohawk Limestone to Expand

INCREASED storage facilities for raw rock and finished products are planned as part of the expansion program of the Mohawk Limestone Products Co., Jordanville, N. Y. Several additional sidetracks in the company's yards to take care of increased production are being built and store room and a fireproof office building 140 ft. long, 60 ft. wide and 60 ft. high is being erected.

The new storage will comprise five monolithic concrete silos, each 96 ft. high and 50 ft. dia., under which will be housed part of the operating equipment. Two of these silos will be used for storing pulverized limestone, and the third will contain hydrated lime, giving an added storage capacity of 25,000 tons of finished products.

With the addition of the store house it will be possible for the company to add another size of crushed stone for next season, this size known as 1-A stone for road resurfacing. This is used extensively in resurfacing concrete highways throughout the state.—*Utica* (N. Y.) *Observer.*

New York State Crushed Stone Association Meets at New York City

THE NEW YORK STATE Crushed Stone Association held its monthly meeting in New York City, October 25. In the absence of the president, James Savage, Buffalo, the secretary, A. S. Owens, Utica, presided. The business session was largely devoted to a discussion of the New York lien law and its effects on the construction materials industry.

At a noon luncheon officers and members of the executive committee of the National Crushed Stone Association were present and various ones were called upon for remarks. Those attending the meeting also took part in the annual meeting and dinner of the Manufacturers' Division of the National Crushed Stone Association, held in the evening of the same day.

Hints and Helps for Superintendents

A Bottom Dump Tramway Car

By E. H. McEuen, Lindsay, Calif.

SEVERAL years ago the writer faced the problem of increasing the capacity of a 24-in. gage track system which was transporting limestone from the quarry to kilns and crushing plant. The cars used were the old type four-wheel end-dump built with the body mounted on a hinge which allowed the body to tip forward at the dumping angle. This arrangement raised the center of gravity so high above the rails that there was a tendency toward top heaviness, and to get the proper dumping angle the wheel base was necessarily short. These cars worked fairly well when only loaded to their normal capacity, but when the demand reached the limit of the haulage capacity and we tried loading them up higher our troubles began.

Due to the peculiar arrangements of the tracks at the crushing plant and over the kilns, it would have been very expensive to change the gage of the track so larger cars could be used and it was impractical to change to a side-dump car. A search was made for a type of car that could be used on this job without finding anything that seemed to offer a solution. So we designed a special car to fit this need which was built in a structural steel shop nearby, and which proved to be a very sturdy piece of equipment.

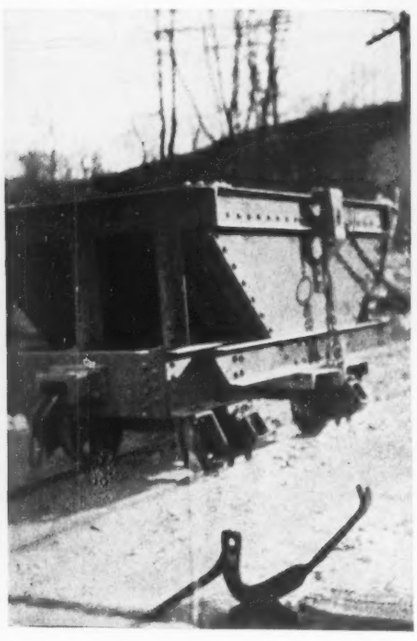


Fig. 1. All-steel bottom-dump quarry car of special design

Fig. 1 shows the general outline of this car, which is a bottom-dump with a dump opening of 24 in. by 48 in. The sides are straight with the ends sloped to the dump opening and the opening is clear with no obstructions whatever to prevent the material from slipping freely from the car. Fig. 2 shows the ratchet arrangement at one end of the car for raising the doors. This ratchet has a positive locking device that prevents the load from dumping while in transit and a trip that allows the load to be dumped readily when the operator is ready. This ratchet shaft extends across the end of the car frame with a spool on each end that holds about a turn and a half of chain, which is all that is needed to raise the doors to closed position. This chain is run through a sheave on each side of the car as shown and connected with the doors at each end. The doors are made of two pieces of heavy 12-in. channel iron which are rigid enough to stand the strain.

Fig. 2. Ratchet arrangement at one end of the car for raising door

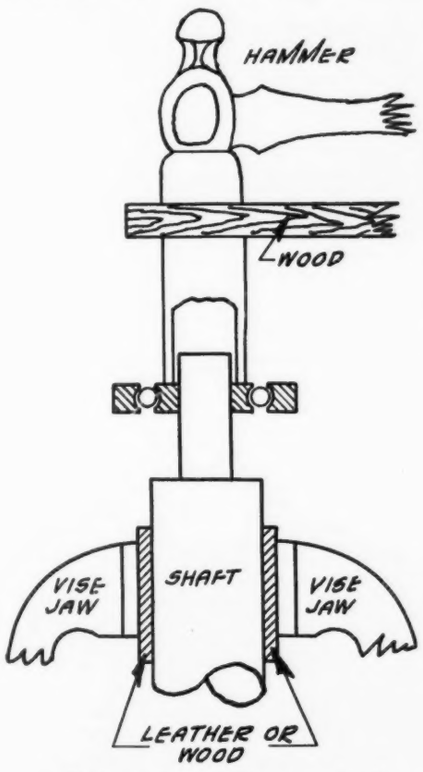
Fig. 3 shows one of these cars in action discharging a load of rock into the bunker over the crusher. The snappy action of the dumping arrangement and the prompt discharge of the load can be readily visualized by a study of this picture. Another advantage is the small amount of physical effort necessary to dump this car as compared to the old type, which had to be turned over by physical force. These cars had a capacity of about one ton more than the old type. The center of gravity was much lower and the load was evenly balanced over the trucks, thus eliminating derailments and other troubles encountered with the old type of car. They were introduced into the system without changing any of the track system, and it was possible to move much more tonnage in a given time with less trouble. One interesting factor in connection with the change was that of distributing the stone more evenly in the kilns. The old type of car dumping at the end often placed most of the large stone on one side of the kiln and the smaller material on the other side. With the new car the difference was very noticeable, as it was possible to spot the car over the center of the kiln and the entire load dropped down evenly, thus maintaining a more uniform condition in the burning zone.

Fig. 3. The car in action—discharging rock to the crusher

Packing and Fitting of Small Ball Bearings

By PAUL F. ROGERS
Brooklyn, N. Y.

BALL bearings are used on so many types of machine that the plant engineer or master mechanic ought to be thoroughly familiar with correct methods of installing and caring for them. In the manufacturer's shops, especially if used on a short shaft, the



Fitting a ball bearing to a shaft

arbor press is the best and easiest method of forcing the bearing on the shaft. In large shops with a machine shop in connection this method can be used in the field, although it is usually more convenient to install the bearing with the shaft in place or at least near the machine where it is used.

With long or inaccessible shafts the oil bath method can be used to advantage. The bearing is shrunk on the shaft by expanding it first in a bath of hot oil heated to 300-350 deg. F. In heating the oil it is best to use hot water or a steam coil so as to avoid the danger of fire.

Ordinarily the quickest and handiest way is to use a hammer, starting the bearing over the shaft by careful taps of the hammer and then driving it the rest of the way to the shoulder by means of a short length of pipe as shown in the sketch. Four points must be carefully watched; the bearing must be started squarely on the shaft; it must be driven down evenly all around—meaning that the driving pipe must be cut off square; the outer ring must not be struck, as it will throw the bearing out of adjustment and last the inner ring must not be struck a sharp direct blow of the hammer, as it is quite easy to crack a hard piece of tempered steel. When driving down the pipe it is well to use a piece of wood or fiber as shown.

Manufacturers ship bearings all adjusted, cleaned and oiled ready for service and after unwrapping the bearing it should not be exposed to dirt and dust so that it has to be washed. Re-cleaning at the plant only increases the possibility of injury due to foreign material. Old bearings that must be cleaned can be washed by first using a solution made by dissolving a cup of washing soda in a bucket of boiling water. The bearings are then dipped in kerosene and worked around until they are free of all dirt and foreign matter, after which they should then be dried thoroughly. Ordinary compressed air is not good for this because it usually contains moisture which condenses out due to the low temperature caused by the expanding air. A small hand blower with or without a heater is best for this drying out.

It is important to have a shaft of the proper size for the bearing which must be round, straight and clean. There should be no taper and the shoulder should be straight and smooth. Rough edges must be cleaned up with a file or emery cloth; this is a common way for dirt and foreign material to find its way into bearings. Both of these are very abrasive and must be completely removed, preferably by an oily rag which serves the double purpose of oiling the shaft and making it easier to remove as well as coating the surface with a film which makes particles of foreign material stand out so that they are easily detected.

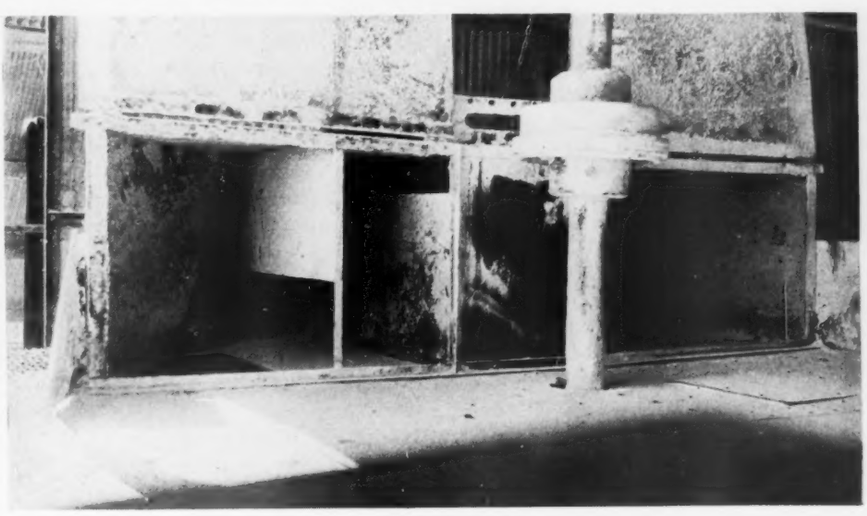
ROCK PRODUCTS will gladly pay $5 for a "hint" worthy of reproduction on these pages. It need not be elaborately illustrated; a rough sketch and outline of the idea is quite suitable.—The Editors.

Fog Stacks on Gypsum Kettles

FOG stacks in gypsum calcining plants, have not as a rule proven at all successful. In several plants, especially in the West, where there is no objection as far as the surroundings are concerned to letting the dust from the kettles discharge direct to the atmosphere, such stacks have been done away with entirely and a straight pipe to convey the steam and entrained dust away from the kettles is in use. The ordinary fog stack is practically useless for the amount of dust it collects is small and of little value. Further it increases the possibility of making defective plaster by allowing the collected dust to be returned to the kettle at the improper time. The old style fog stack or fog box was very apt to accumulate several hundred pounds, even tons of material and then perhaps just as the kettle was being dumped this mass would sluff off and fall into the kettle, returning practically raw gypsum to the freshly cooked plaster.

At the Plaster City plant of the Pacific Portland Cement Co., Consolidated, a simple modified fog stack has been in use for some time and has proven very satisfactory from all angles. It was developed by Joe Pierri, general mill foreman of that company's plant at Gerlach, Nev.

The fog box rests directly on top of the kettle and is divided into two identical compartments, only one being used during a calcining cycle, so that the operator can clean out one compartment and allow the dust to fall back into the kettle while the other compartment is functioning. The dust collected during one cycle is returned to the kettle at the beginning of the next and assures always a clean fog box as well as the ability to return collected dust at the proper time. The compartments are provided with baffles to change the direction of flow of the entrained dust. The boxes are made of light weight sheet iron and in the shops of the company.



Two-compartment fog box over the gypsum kettle

Municipal Airport Conference

Reported for Rock Products by P. J. Freeman
Chief Engineer, Bureau of Tests and Specifications, Allegheny County Department of Public Works, Pittsburgh, Penn.

THE FIRST MUNICIPAL AIRPORT conference held under the auspices of the City Officials Division of the American Road Builders' Association, met in Washington, D. C., on October 24 and 25, 1929.

On first thought, one may be surprised that the American Road Builders' Association should interest itself in the construction of airports. After attending this conference and learning some of the many problems to be solved in airport construction, one is inclined to believe that the builders of highways will eventually have to play a very large part in the construction of airports in the future. It seems quite as logical for a municipality to provide airports for the landing and parking of vehicles from the air as it is to provide roadways for automobiles and parking space for them.

At the present time there are about 2000 airports in existence or under process of construction, of which 17 are larger than 500 acres. Undoubtedly municipalities will find it necessary to greatly increase the acreage of their airports. It was pointed out at the meeting that commercial companies owning airports will dispose of their property whenever the financial gain from the real estate transaction is greater than that from the operation of the airport. For that reason, it is a vital necessity for municipalities to purchase at an early date enough land to provide for the future expansion of airport facilities sufficient to satisfy the needs for many years to come. Since the municipal airport will not be sold, the people of the city will be assured a landing field within a reasonable distance from the business center in spite of any increase in land values due to the operation of such an airport.

Allegheny County, including the City of Pittsburgh, Penn., is building an airport which will ultimately cover approximately 1300 acres. The first stage involves the moving of approximately 3,000,000 cu. yd. of material, which will establish a level landing area of approximately 400 acres.

It will be necessary to construct at least five miles of runways about 300 ft. wide to properly serve the future needs of the air-traveling public. The labor and engineering necessary to provide proper drainage for such runways will require men experienced in high grade road building. Whether the type of surface to be used is flexible or rigid, the building of such runways will be equivalent to constructing approximately 75 miles of pavement, and undoubtedly the American Road Builders' Association is showing great foresight in getting organized to help handle such problems.

No attempt has been made to abstract the various papers presented at the meeting as they will be available through the American Road Builders' Association.

Papers presented at the meeting showed the enormous progress which has been made in this country during the past three years as compared with the progress made in European countries during the past ten years. It would appear that progress in the design of properly constructed airports is as great as that which has been made in radio during the same period of time and we have not yet gotten really started on future developments.

B. Russell Shaw, president of a company by the same name in St. Louis, Mo., discussed airport layout and planning. He pointed out the importance of planning for the future and acquiring a sufficient area of land to provide for the necessary expansion which will undoubtedly come in air traffic.

The subject of airport structures was discussed by Kenneth Franzheim, architect, Curtis Airport Corp., who emphasized the importance of having a general architectural plan under which buildings constructed by the municipality and by all companies leasing land for hangars, etc., would conform to the same general architectural scheme.

C. A. Hogentogler, senior engineer, United States Bureau of Public Roads, discussed drainage for airports and brought out the importance of proper drainage for runways.

Airport surfaces were thoroughly covered by C. N. Conner, engineering executive, American Road Builders' Association. The report included the various types of surfaces which may be used for airplane runways and listed the principal advantages and disadvantages of each type.

A. P. Talliaferro, division of aeronautics, United States Department of Commerce, brought out the importance of scientific and comprehensive knowledge of the various factors entering into the management of airports, if they are to be made profitable.

The manager of the Buffalo airport, N. E. Duffy, discussed the future of airport progress and the methods used in Buffalo for the accommodation of passengers and traffic. He pointed out that, in many instances, it will be necessary to provide facilities for handling immigration and customs.

The practice in European airports was discussed by Col. C. M. Young, assistant secretary of commerce for aeronautics, who described a trip which he made to various European centers. Colonel Young shipped his own airplane to Europe, where it was reassembled, and he visited a number of airports with it. On account of fogs, and various other conditions, he was not able to visit all of the air centers by plane, but was obliged to use other means of transportation. The report showed the type of airport and structures used in Europe.

The chairman of the meeting was Col. H. H. Blee, chief, division of airports and aeronautical information, United States Department of Commerce, who contributed valuable suggestions, at various times, throughout the meeting in connection with the papers as presented.

Anyone attending the meeting could not help being impressed with the fact that aviation is in its earliest infancy and that the development of airports and similar facilities will undoubtedly follow in the same, or in greater magnitude, than the improvement of highways has from the use of the automobile. The possibilities for future use of the airplane, not only in this country, but in isolated localities, such as in Alaska, were pointed out by many other speakers of national prominence, who expressed their views on the necessity for broad and comprehensive planning in the selection and construction of municipal airports.

Large Blast at Superior Quarry

THE big blast at the Concrete, Wash., quarry of the Superior Portland Cement Co., premature explosion of part of which caused a fatal accident on October 14 (see ROCK PRODUCTS, October 26, 1929, p. 81), was fired on October 15 as a matter of quarry routine and without the large crowd of spectators that had been planned for the occasion. The hole which exploded prematurely and two other well holes were not loaded, but even with these missing, the blast was one of the largest ever shot at the quarry. There were over 25 tons of powder used in the blast and over 200,000 tons of rock were brought down. The jar of the blast was barely felt in town, and the sound of the explosion was no greater than from an ordinary shot.—*Concrete Herald.*

Regarding the fatal accident at the quarry of the Superior Portland Cement Co. (ROCK PRODUCTS, October 26, 1929), one of the company's officials has written us as follows:

"We had loaded 12 out of 15 well drill holes and were loading the thirteenth, a 208-ft. deep hole, when the explosion occurred.

"Forty cases of Du Pont gelatin and 15 cases of Trojan had been loaded when the powder company representative, Mr. White, instructed one of the men to lower the measuring weight. The measurement was taken, and on drawing the weight up, the explosion occurred.

"One man, Fred Baker, was instantly killed, another, Eddy Wolbert, was fatally injured. Three, Mr. White, William Doyle and Pete Mazis, were seriously injured, and two men, Guy Frank and Fred Heeck, were slightly injured.

"The investigation so far has disclosed no cause for the premature explosion."

Editorial Comment

Stock Market and Rock Products

Along with other industrial stocks those of rock products companies suffered considerable reductions in stock market quotations during the recent avalanch of selling. This, as every business man knows, does not mean that these particular industrial stocks have suffered any reduction in real value, since their real investment value is determined by their present and prospective earnings. These stocks have not been speculated in to any extent and consequently did not acquire fictitious trading values prior to the "grand slam."

Recovery of these stock prices, in many instances, will undoubtedly be slow because of the effect on earnings of recent price slashing in the portland cement industry itself and the doubtful status of the tariff bill, now before the United States Senate. The recovery of industrial stock prices as a whole will probably be slow because much of the buying which finally saved the market was done for that specific purpose and these purchases in many cases will be liquidated in the next few weeks or months.

On the whole, the deflation of speculative values in stocks and the consequent curbing of stock speculation for a period will undoubtedly be very much to the benefit of the rock products, building construction materials industry. The high interest rates of the last year have made a poor bond market, and nearly all building, especially public works construction, is dependent upon a favorable bond market. The financial authorities all agree, apparently, that we are entering such a bond market now, so the prospects for the rock products industries in 1930 are mighty good, stock market quotations, notwithstanding.

Out in the Open

A rather significant event took place at Springfield, Ill., November 6. The brick manufacturers of Illinois, as a group, had an open session with the governor of the state, the chief highway engineer, and other authorities, in an endeavor to convince them that the state should build brick-paved roads. The meeting seems to have been well organized, the Illinois brick manufacturers having the active aid of the officers of the National Paving Brick Manufacturers Association and of labor union officials. It may be, of course, that the paving brick manufacturers adopted this method after having exhausted all other means of influencing the state's purchase of highway material, but we are inclined to believe it marks a change of front on the part of these construction material interests, and that in the future we shall see a greater effort made to accomplish results openly rather than by the more usual devious methods of the past. Unfortunately for the public interest the session was not conducted so as to provide for rebuttal arguments against the use of paving brick!

Rock Products Research Accomplishments

In the few years that the laboratories of the National Crushed Stone Association and the National Sand and Gravel Association have been really functioning, the work they have done has amply justified their cost and maintenance. The bugaboo of flats in gravel has been laid to rest; the effect of stone dust has been shown to be so slight as to be negligible (with proper mixing); the relationship between voids and gradation has been established for sand, gravel and crushed stone and now the sodium sulphate test, which has long been under suspicion, has been definitely shown to be ready for the discard.

The comparative tests of gravel and stone as coarse aggregates where flexural strength is wanted have caused some controversy, but they are the beginning of real research in the properties of aggregates. They have shown that the present method of using arbitrary proportions is a very clumsy and uneconomical method of making concrete and have pointed the way to a new method, one in which *all* the factors will be taken into account.

But the producer, whose money has built and now maintains these laboratories, while he may appreciate how important these results are from a technical point of view, will first want to know if they will help him to sell more aggregates or to get a better price for what he does sell. Unquestionably it will do both these things in time if it is not doing them now. The whole concrete industry has been built up by research, and research along the usual lines has about come to a standstill. Not only the water-cement ratio law but the design of concrete by the use of the water-cement ratio (for compressive strength) is now too well established to need further confirmation. What is needed now is research in materials and a recognition of the differences in materials. Most of the older research ignored the differences in materials in order to fix attention on the basic principles of concrete mix design and concrete physics. It was the right thing to do at the time, perhaps, but the time has come to take them into account if the concrete industry is to advance. And the greatest advance will be made in economy. As F. H. Jackson pointed out in one of his papers on concrete mix design, the strength of conerete is satisfactory in most cases now, but, while we may not get any better concrete by using more scientific methods of mix design, we shall get it more economically.

The competition of today is not between individuals or corporations, it is between products. Concrete had to push into a crowded field to get started and it has had to fight to maintain its position. The results of research were its only weapons. Now that the three great producing associations have research laboratories there will be more and more detailed research to help it in a further advance.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[29]	10-23-29	91	93	
Alpha P. C. new com.	11- 4-29	29⅛	29½	75c qu. Oct. 15
Alpha P. C. pfd.	11- 4-29	116	.....	1.75 Sept. 14
American Aggregates com.[29]	10-23-29	20	30	75c qu. Mar. 1
Amer. Aggregate 6's, bonds	11- 4-29	94	.....	
American Brick Co., sand-lime brick	11- 4-29	.....	15	25c qu. Feb. 1
American Brick Co. pfd., sand-lime brick	10-21-29	.....	80	50c qu. Nov. 1
Am. L. & S. 1st 7's[23]	10-23-29	96	98	
American Silica Corp. 6½'s[49]	11- 6-29	90	100	
Arundel Corp. new com.	11- 4-29	40½	41	50c qu. Oct. 1
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	11- 6-29	No market		
Atlas P. C. com.	11- 4-29	37	40	50c qu. Sept. 3
Beaver P. C. 1st 7's[20]	11- 1-29	97	100	
Bessemer L. & C. Class A[4]	11- 1-29	28	30	75c qu. Nov. 1
Bessemer L. & C. 1st 6½'s[4]	11- 1-29	90	94	
Bloomington Limestone 6's[29]	10-23-29	86	87	
Boston S. & G. new com.[47]	11- 4-29	17	21	40c qu. July 1
Boston S. G. new 7% pfd.[47]	11- 4-29	47	51	87½c qu. July 1
Calaveras Cement 7% pfd.	10-31-29	85	.....	
Calaveras Cement com.	10-31-29	18	.....	
Canada Cement com.	11- 4-29	20	21	
Canada Cement pfd.	11- 4-29	94	95	1.62½ qu. Sept. 30
Canada Cement 5½'s[48]	11- 1-29	97	98½	
Canada Cr. St. Corp. 1st 6½'s[43]	11- 1-29	95	98	
Can. Gyp. & Alabastine (new)*	11- 4-29	24½	24⅞	37½c qu. Oct. 1
Certainteed Prod. com.	11- 4-29	17	19	
Certainteed Prod. pfd.	11- 4-29	51	60	1.75 qu. Jan. 1
Cleveland Quarries new st'k	11- 6-29	67	70	50c 25c ex. Sept. 1
Columbia S. & G. pfd.	11- 4-29	81	86	
Consol. Cement 1st 6½'s. A[42]	11- 6-29	90	92	
Consol. Cement 6½% notes[24]	11- 6-29	80	85	
Consol. Cement pfd.[29]	10-23-29	50	60	
Consol. Oka S. & G. 6½'s[12] (Canada)	10-19-29	100	102	
Consol. Rock Prod. com.[9]	10-31-29	.....	10	
Consol. Rock Prod. pfd.[20]	11- 1-29	15	17	
Consol. Rock Prods. units[20]	7-27-29	52	53	
Consol. S. & G. pfd. (Can.)	11- 5-29	.....	86	1.75 qu. Nov. 15
Construction Mat. com.	11- 4-29	22½	23¼	
Construction Mat. pfd.	11- 4-29	41½	42	87½c qu. Nov. 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[18]	10-31-29	96	98	
Coosa P. C. 1st 6's[29]	10-23-29	50	55	
Coplay Cem. Mfg. 1st 6's[40]	10-21-29	90	.....	
Coplay Cem. Mfg. com.[40]	10-21-29	10	.....	
Coplay Cem. Mfg. pfd.[40]	10-21-29	70	.....	
Dewey P. C. 6's[30] †(1942)	11- 6-29	100	.....	
Dewey P. C. 6's[30] (1930)	11- 6-29	99	.....	
Dewey P. C. 6's[30] (1931-41)	11- 6-29	96½	.....	
Dolese & Shepard	11- 4-29	100	105	
Edison P. C. com.[39]	11- 4-29	10c	.....	
Edison P. C. pfd.[39]	11- 4-29	25c	.....	
Giant P. C. com.[25]	11- 4-29	10	25	
Giant P. C. pfd.[25]	11- 4-29	10	25	3½% s.-a. June 15
Ideal Cement, new com.[33]	11- 4-29	57	62	75c qu. Oct. 1
Ideal Cement 5's, 1943[33]	11- 4-29	95	100	
Indiana Limestone units[29] (5 shs. com. & 1 sh. pfd.)	10-23-29	90	.....	
Indiana Limestone 6's	11- 4-29	77	77⅛	
International Cem. com.	11- 4-29	58	59	$1 qu. Sept. 27
International Cem. bonds 5's	11- 4-29	92½	93	Semi-ann. int.
Iron City S. & G. bonds 6's[46]	9-20-29	85	90	
Kelley Is. L. & T. new st'k	11- 6-29	48	50	62½c qu. Oct. 1
Ky. Cons. St. com. Voting Trust Certif.[48]	10-30-29	12	13	
Ky. Cons. Stone 6½'s[48]	10-30-29	95	100	
Ky. Cons. Stone pfd.[48]	10-30-29	95	100	
Ky. Cons. Stone com.[48]	10-30-29	12	13	
Lawrence P. C.	11- 4-29	50	65	$1 qu. Sept. 28
Lawrence P. C. 5½'s, 1942	10- 9-29	84	90	
Lehigh P. C.	11- 4-29	33	35	62½c qu. Nov. 1
Lehigh P. C. pfd.	11- 4-29	100	102	1¾% qu. Oct. 1
Louisville Cement[7]	11- 1-29	230	.....	
Lyman-Richey 1st 6's, 1932[12]	11- 1-29	97	100	
Lyman-Richey 1st 6's, 1935[18]	11- 1-29	95	98	
Marblehead Lime 6's[14]	11- 1-29	98	100	
Material Service Corp.	11- 6-29	18	28	50c qu. Dec. 1
Medusa Portland Cem.[29]	10-23-29	120	123	1.50 Oct. 1
Mich. L. & C. com.[6]	11- 4-29	35	.....	
Missouri P. C.	11- 4-29	35½	36½	50c qu., 50c ex. Nov. 1
Monolith Midwest[9]	10-31-29	8½	10	
Monolith bonds, 6's[9]	10-31-29	97	98	
Monolith P. C. com.[9]	10-31-29	13½	14	40c s.-a. July 1
Monolith P. C. pfd.[9]	10-31-29	9	9½	40c s.-a. July 1
Monolith P. C. units[9]	10-31-29	31½	33	
National Cem. (Can.) 1st 7's[38]	11- 4-29	96	.....	
National Gypsum A com.	11- 4-29	10	12	
National Gypsum pfd.	11- 4-29	45	50	
Nazareth Cem. com.[26]	10-19-29	15	25	
Nazareth Cem. pfd.[26]	10-19-29	95	100	
Newaygo P. C. 1st 6½'s[29]	10-23-29	101½	.....	
New Eng. Lime 1st 6's[14]	11- 1-29	95	98	
N. Y. Trap Rock 1st 6's	11- 4-29	94	.....	
North Amer. Cem. 1st 6½'s	11- 4-29	47⅜	49⅞	
North Amer. Cem. com.	10-31-29	3	.....	
North Amer. Cem. 7% pfd.[29]	10-23-29	.....	29	1.75 qu. Aug. 1
North Amer. Cem. units[29]	10-23-29	.....	33	
North Shore Mat. 1st 5's[15]	11- 6-29	93	.....	
Northwestern States P. C.[37]	7-26-29	140	.....	2% Oct. 1
Ohio River Sand com.	11- 4-29	28½	30	
Ohio River Sand 7% pfd.	11- 4-29	100	102	
Ohio River S. & G. 6's[16]	11- 4-29	80	90	
Pac. Coast Agg. 6½'s	8-29-29	99	.....	
Pac. Coast Agg. 7's	8-29-29	99	.....	
Pac. Coast Cem. 6's, A[5]	10-17-29	.....	95	
Pacific Lime Co. pfd.[43]	9- 6-29	No market		
Pacific P. C. com.	10-31-29	24	25	
Pacific P. C. pfd.	10-31-29	75	77	1.62½c qu. Oct. 5
Pacific P. C. 6's[5]	10-17-29	99¼	100	
Peerless Egyp'n P. C. com.[21]	11- 4-29	1½	2½	
Peerless Egyp'n P. C. pfd.[21]	11- 4-29	84	88	1.75 Oct. 1
Penn-Dixie Cem. 1st 6's	11- 4-29	68	.....	
Penn-Dixie Cem. pfd.	11- 4-29	34	36	1.75 qu. Sept. 15
Penn-Dixie Cem. com.	11- 4-29	7	7½	
Penn. Glass Sand Corp. 6's	10- 9-29	100	101	
Penn. Glass Sand pfd.	10- 9-29	115	.....	1.75 qu. Oct. 1
Petoskey P. C.	11- 4-29	8½	9½	1½% qu. Sept. 1
Riverside P. C. com.	10-31-29	.....	25	
Riverside P. C. pfd.[20]	11- 1-29	80	85	1.50 qu. Nov. 1
Riverside P. C., A[20]	11- 1-29	.....	16	31¼c qu. Nov. 1
Riverside P. C., B[9]	10-31-29	5	.....	
Santa Cruz P.C. 1st 6's, 1945	10-31-29	108½	.....	6% annually
Santa Cruz P. C. com.	10-31-29	95	.....	$1 qu. Oct. 1
Schumacher Wallboard com.	10-31-29	.....	15	
Schumacher Wallboard pfd.	10-31-29	22½	24½	50c qu. Aug. 15
Southwestern P. C. units[44]	10-17-29	270	.....	
Standard Paving & Mat. (Can.) com.	11- 4-29	25	26	50c qu. Nov. 15
Standard Pav. & Mat. pfd.	11- 4-29	.....	89	1.75 qu. Aug. 15
Superior P. C., A	10-31-29	38	40	27½c mo. Oct. 1
Superior P. C., B	10-31-29	13⅜	14	
Trinity P. C. units[37]	7-26-29	142	150	
Trinity P. C. com.[37]	7-26-29	51	.....	
Trinity P. C. pfd.[29]	10-23-29	110	115	
U. S. Gypsum com.	11- 4-29	71½	72	2% qu. Sept. 30
U. S. Gypsum pfd.	11- 6-29	120	125	1¾% qu. Sept. 30
Universal G. & L. com.[8]	11- 6-29	No market		
Universal G. & L. pfd.[8]	11- 6-29	No market		
Universal G. & L., V.T.C.[8]	11- 6-29	No market		
Universal G. & L. 1st 6's[8]	11- 6-29	No market		
Warner Co. com.	11- 4-29	43	43⅞	50 qu., 50c ex. Oct. 15
Warner Co. 1st 7% pfd.	11- 4-29	100	104	1¾% qu. Oct. 1
Warner Co. 1st 6's[8]	11- 6-29	98½	101	
Whitehall Cem. Mfg. com.[36]	10-31-29	125	.....	
Whitehall Cem. Mfg. pfd.[36]	10-31-29	98	.....	
Wisconsin L. & C. 1st 6's[15]	11- 6-29	93	.....	
Wolverine P. C. com.	11- 4-29	5	6	15c qu. Nov. 15
Yosemite P. C., A com.[30]	11- 1-29	2½	3¼	

†$484,000 called for redemption at 103½ October 1. *Dividend equivalent to $6 per share per annum on old capital stock recently split up on a 4 for 1 basis and on which quarterly dividends of 75c per share were paid.

[1]Quotations by Watling Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by Rogers, Tracy Co., Chicago. [4]Quotations by Butler Beadling & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]By J. J. B. Hilliard & Son, Louisville, Ky. [8]Quotations by Dillon, Read & Co., Chicago, Ill. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [12]Nesbit, Thomson & Co., Montreal, Canada. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Peters Trust Co., Omaha, Neb. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co., of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hoit, Rose & Troster, New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simons & Co., Inc., Detroit, Mich. [22]Hemphill, Noyes & Co., New York City, N. Y. [23]Blair & Co., New York and Chicago. [24]A. B. Leach & Co., Inc., Chicago. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [32]A. E. Ames & Co., Toronto, Can. [33]Boettcher Newton & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [38]McFetrick & Co., Montreal, Que. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [41]Hornblower & Weeks, New York City and Chicago. [42]E. H. Rollins, Chicago, Ill. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney, Williams & Co., Inc., Los Angeles, Calif. [45]Taylor Ewart & Co. [46]Stein Bros. & Boyce, Baltimore, Md. [47]Wise, Hobbs & Arnold, Boston. [48]E. W. Hays & Co., Louisville, Ky. [49]Blythe Witter & Co.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
American Brick Co. pfd., 50 sh.[5] (par $25) per sh.	22½ ex-div.	.....
American Brick Co. com., 20 sh.[8]	$10 per share	.....
American Brick Co. pfd., 20 sh.[8] (par $25)	$18 per share	.....
International Portland Cement Co., Ltd., pfd.	30	45
New England Lime Co. Series B, 60 sh.[9]	$15 per share	.....
Rockland & Rockport Lime Co. 2nd pfd.[7] 13½ sh.	2⅞ per snare	.....
Rockland & Rockport Lime Co. com.[7] 14½ sh.	55c per share	.....
Seaboard P. C.[1] 6% bonds ($7.500) 7-1-27. July 1910. and subsequent coupons attached	$10 for the lot	.....
Southern Phosphate Co.[6]	1¼	.....
Universal Gypsum com. free stk.[1] 300 shares	$75 for the lot	.....
Universal Gypsum com.[1] 153 shares (no par)	$51 for the lot	.....
Vermont Milling Products Co. (slate granules), 22 sh. com. and 12 sh. pfd.[6]	$1 for the lot	.....
Winchester Rock Brick Co., pfd., 1 share (par $25) and 1 share com. (par $10)[6]	$8 for the lot	.....

[1]Price obtained at auction by Adrian H. Muller & Sons, New York. [5]Price at auction by R. L. Day & Co., Boston, October 23, 1929. [6]Price at auction by Wise, Hobbs & Arnold, Boston, Mass., June 19, 1929. [7]Price obtained at auction by R. L. Day & Co., August 21, 1929. [8]Price at auction by Wise, Hobbs & Arnold, Boston, October 16. [9]Price at auction by R. L. Day & Co., Boston, October 16.

How the Stock Market Slump Affected Rock Products Securities

THE table below shows how some of the typical securities in the rock products industry have been affected by the recent slump in stock exchange quotations, and their partial recovery. The highs and lows for the year are given; the highs are not necessarily quotations immediately preceding the week of October 20, but are highs for the year prior to then. The lows occurred chiefly on October 29, when all industrial stocks hit bottom on the New York Stock Exchange and other exchanges.

PRICE RANGE OF VARIOUS ROCK PRODUCTS COMPANIES SECURITIES DURING 1929

	1929 High	1929 Low	Nov. 4, 1929 Bid	Nov. 4, 1929 Ask
Alpha Portland Cement com.	56	29	29⅛	29¼
Arundel Corp.	45	35½	40½	41
Atlas Portland Cement com.	55	35	37	40
Certain-teed Products com.	32	13	17	19
Certain-teed Products pfd.	81½	47½	51	60
Construction Materials com.	38	15	22½	23¼
Construction Materials pfd.	55	26½	41½	42
Dolese & Shepard	127	90	100	105
International Cement	102¾	54½	58	59
Lawrence Portland Cement	97	50	50	65
Lehigh Portland Cement com.	65	34	33	35
Lehigh Portland Cement pfd.	110¾	102	100	102
Missouri Portland Cement	54¼	33	35½	36½
National Gypsum A	26	10	10	12
National Gypsum pfd.	58	45	45	50
Penn.-Dixie Cement com.	27	5⅛	7	7½
Penn.-Dixie Cement pfd.	94	33	34	36
Petoskey Portland Cement	10¾	9½	8½	9½
United States Gypsum com.	92¼	52	71½	72
Warner Co. com.	54¾	35	43	43⅞
Wolverine Portland Cement com.	8	4	5	6

Arundel Corp. Earnings

THE Arundel Corp., Baltimore, Md., reports for the nine months ended September 30, 1929, net income of $1,640,695 after all charges, equal to $3.33 a share on the 492,556 capital shares outstanding. This compares with $1,079,170 or $2.19 a share in the corresponding period of 1928.

Net income for the quarter ended September 30, was $700,569 or $1.42 a share as against $477,187 or 97c. a share in the similar quarter of 1928.

Northwestern Cement Earnings First Eight Months

THE Northwestern Portland Cement Co. during first 10 months of its current fiscal year, which ends November 30, earned approximately $115,000 after charging off $40,000 for depreciation and estimated federal taxes.

Since the company has 13,500 shares of its $100 par 8% preferred stock outstanding, on which annual dividend requirements amount to $108,000, it is evident that the company's earnings for the 10 months ending September 30 exceeded the preferred stock requirements. Various expense-saving machinery has been installed at the company's plant at Grotto, Wash., effect of which is now being reflected in lower manufacturing costs and resultant profits.

So far during 1929 the company has paid 6% on its preferred stock, last 2% payment being made August 25. While these payments do not entirely wipe out arrearages on preferred that became outstanding at various dates between September, 1926, and date of initial production, May, 1928, the company's earnings indicate that continuance of dividend payments can be expected.

The company's current position is excellent. As of August 31, quick assets were $289,217, current liabilities $38,023, a ratio of assets to liabilities of 7.6 to 1. Quick assets consisted of $195,389.28 accounts receivable and cash, and $93,827.92 of inventory. From stockholders' viewpoint, company's capital structure is advantageous, since against earnings there are no prior liens of bonded debt interest, and ample working capital makes bank loans unnecessary.

In order to strengthen its position in the Seattle trade territory, the company has acquired 75 acres of sand and gravel waterfront property on Maury Island, in the Vashon Island group, 20 miles from Seattle, 10 miles from Tacoma. This property, containing large deposits of desirable paving material, will be developed when the company's management believes such a step is desirable. Northwestern's trade territory extends south to Portland, north into Canada, east to Yakima, Wenatchee, Prosser and the entire Puget Sound territory. As of August 31, last, the company's balance sheet showed total assets of $1,456,652.69.

Northwestern's present cement shipments are said to be heavy, and due to existing contracts, officials of the company expect business to remain on the present level for the balance of the current year.—*Chapman's Financial Weekly* (Portland, Ore.).

Construction Materials Corp. Earnings

IN A LETTER to the stockholders of the Construction Materials Corp., Chicago, Ill., sand and gravel producer, J. R. Sensibar, president, says:

"With the fourth quarter well on its way, the company is completing a very satisfactory year. From present indications, earnings should be at least as good as those for 1928, which established a new high record for the company and were equivalent to $13.41 per share of convertible preference stock outstanding and, after allowance for preference stock dividends, to $4.02 per share on common."

Mr. Sensibar points out the growing importance of "made land" to industry, and stated that several large contracts for materials for such projects had been awarded the company recently.

Calaveras Cement Company Earnings

NET earnings of $303,874 for the first nine months of 1929, equal to $2.43 per share on the 125,078 shares of common stock outstanding, are reported by the Calaveras Cement Co., San Francisco, Calif., through a statement released jointly by Wm. Cavalier and Co. and Dean Witter Co. These figures are after all charges including approximately $97,500 for depletion and depreciation, and are at the annual rate of $3.25 per share on the common stock.

The report further shows that dividend requirements on the company's outstanding preferred stock were earned more than 3½ times during this period. Net available for preferred dividends was $416,564 against dividend requirements of $112,690. The company has no funded debt. Unfilled orders now on the company's books indicate that operations for the final quarter will be satisfactory, according to the officials of the company.

Balance sheet as of September 30, 1929, discloses ratio of current assets to current liabilities of more than 5 to 1. Cash on hand is shown at $577,788 and net working capital over $1,100,000.

Warner Company Earnings

THE Warner Co., Philadelphia, Penn., engaged in sand, gravel and lime business, etc., reports for quarter ended September 30, 1929, net profit of $525,441 after interest, depreciation, depletion and federal taxes, equivalent after dividend requirements on first and second preferred stocks, to $1.82 a share on 203,451 shares of no-par common stock. This compares with $553,542, or $1.96 a share, on 203,000 common shares in preceding quarter.

Republic Portland Cement Bond Issue

THE Hibernia Securities Co., New Orleans, La., the First National Co., St. Louis, Mo., the Alamo National Co., San Antonio, Tex., the Republic National Co., Dallas, Tex., and the City Central Bank and Trust Co., San Antonio, Tex., are offering $1,250,000 first mortgage 6% sinking fund gold bonds (with stock purchase war-

rants) of the Republic Portland Cement Co., San Antonio, Tex. The bonds are dated September 1, 1930, and are due September 1, 1943. The bonds are callable at 103. The prospectus includes the following data:

Guaranty—Bonds are unconditionally guaranteed as to both principal and interest by endorsement of F. A. Smith and J. H. Smith.

Warrants—Each $1000 bond will have attached a warrant, non-detachable prior to January 1, 1931, entitling the holder to purchase 10 shares of outstanding common stock at any time on or before December 31, 1920, at $7.50 per share; thereafter at any time on or before December 31, 1931, at $10 per share; thereafter at any time on or before December 31, 1932, at $12.50 per share and thereafter at any time on or before December 31, 1933, at $15 per share. The warrants shall be void unless exercised on or prior to December 31, 1933. The warrants will provide for necessary adjustment in the event of stock dividends. The $500 bonds will bear similar warrants to purchase five shares of the common stock of the company.

Company—Organized in Texas to engage in the manufacture and sale of Portland cement. Company owns 475 acres of land lying approximately 10 miles northeast of San Antonio and served by the main lines of the Missouri Pacific and the Missouri-Kansas-Texas Railroads. Richard K. Meade and Co. of Baltimore, a nationally recognized cement authority, and Terrell Bartlett, Enginers, Inc., of San Antonio, have reported that this tract of land contains raw materials unusually well adapted for economical mining and manufacture of high-grade portland cement sufficient to supply the present annual manufacturing capacity for over 100 years. Upon this land the company has completed under the plans of Richard K. Meade and Co. and Terrell Bartlett Enginers, Inc., a modern portland cement plant, of 1,250,000 bbl. annual capacity, equipped with the latest types of cement-making machinery.

Earnings—Based on actual cost of producing cement since the company began operation, on August 20, 1929, the company has estimated that its net earnings for the first full year of operation, after operating expenses, local taxes and depreciation will be in excess of $600,000 or eight times the maximum annual interest requirement on the $1,250,000 of these bonds presently outstanding. Company has already shipped over 50,000 bbl. of cement, and has orders on hand sufficient to operate the plant for over three months.

Purpose—Proceeds of this issue of bonds have been used to reimburse Smith Bros., Inc., in part, for advances made by them in connection with the completion of the plant.

Sinking Fund—Indenture provides that company shall create a monthly sinking fund calculated to be sufficient to retire more than 74% of this issue by maturity. In addition company has covenanted to pay into the sinking fund an additional amount equal to the amount by which 25% of the net earnings of the company as defined in the indenture exceeds the regular monthly sinking fund provided above. Moneys in the sinking fund shall be used to purchase bonds of this issue if obtainable in the open market at or below 103 and accrued interest, and if not so obtainable, to call bonds by lot.

FINANCIAL STATEMENT AS OF SEPTEMBER 1, 1929

ASSETS

Cash	$ 50,444
Accounts payable	46,877
Inventory	141,998
Land, including quarry	584,000
Buildings and plant	1,069,351
Machinery	1,521,004
Track service department	209,726
Employes' village	99,533
Furniture and equipment	22,875
Deferred assets	8,978
Total	$3,754,788

LIABILITIES

Accounts payable	$ 5,357
First mortgage bonds	1,250,000
7% preferred stock	1,250,000
Common stock (245,532 shares)	1,249,431
Total	$3,754,788

Security Materials Co., Los Angeles, Bonds

THE John M. C. Marble Co., Los Angeles, Calif., is offering $300,000 in first mortgage 7% sinking fund gold bonds, dated October 1, 1929, due October 1, 1939, of the Security Materials Co. The company was organized in July, 1926. With the exception of Chas. E. Seaman, all of the officers and executives were formerly connected with the Geo. L. Eastman Co. and were a most active part of that organization. Their experience and connections were such that the business of the company has been profitable from the start. There are but seven stockholders, all of them active, and no stock has been sold to the public. The officers and directors are as follows: Chas. E. Seaman, president; V. S. Hoy, vice-president; J. W. F. White, secretary; Chalmer C. McWilliams, treasurer; Kennedy Ellsworth, general manager; Leonard E. Harbach, Jr., and George H. Yardley, directors.

Business and Property—The company does a well-rounded busines in the sale of building materials, including rock, sand, cement, lime, plaster, steel, wallboard and other established lines required by the building industry, many of which are handled under exclusive agency contracts.

The mortgaged property includes a 46-acre tract and an 88-acre tract in the Big Tejunga Wash, San Fernando Valley, and a 30-acre tract near Lankershim. The last two properties are improved with modern equipment and bunkers for the production and handling of rock and sand, having a capacity in excess of 100,000 tons per month which is adequate for the needs of the company. These quarries, conveniently located in close proximity to the active business districts of Los Angeles and Hollywood, enable the company to deliver its products direct to the consumer.

The main offices and distributing warehouse are located at 916 North Formosa Avenue, Los Angeles. This property is held under a ground lease on satisfactory terms. Spur trackage is provided with a capacity of fourteen cars and the warehouse is arranged for most efficient handling of deliveries either by rail or truck. Building construction is very active in the districts which are economically served from this yard. A branch yard at 2800 South Alameda Street, Los Angeles, has ample facilities for serving all jobs in Metropolitan Los Angeles as well as the large industrial developments on the east side.

Valuation—The mortgaged property has been appraised by W. A. Avey as follows:

Lankershim plant	30 acres (fee)	$158,285.00
Kellerman plant	88 acres (fee)	483,670.00
Acosta property	46 acres (fee)	138,000.00
		$779,955.00

In addition to the above security the stockholders of the company have signed a waiver of the statute of limitations covering stockholders' liability.

The balance sheet as prepared by A. D. McLeod and Co., certified public accountants, shows net current assets of $140,274.07 and total assets of $1,186,894.22, or $3,956.31 for each $1000 bond issued.

Earnings—The following comparative schedule shows the earnings of Security Materials Co. for the past three years:

NET INCOME AVAILABLE FOR BOND INTEREST, EXCEPTING FEDERAL INCOME TAX

1929*	$27,939.00
1928	49,580.31
1927	43,865.99

*January 1 to July 31, 7 months.

It is estimated that the above earnings will be materially increased as a result of the acquisition by the company of its own supply of rock and sand, the cost of which has been met in part by this financing.

Sinking Fund—A sinking fund of five cents per ton of rock and sand produced and sold with a guaranteed minimum of $15,000 per annum has been established. It is expected that the operation of this fund will retire all outstanding bonds before maturity.

Canadian Paving and Supply Co. Preferred Offered

McLEOD, YOUNG, WEIR AND CO., investment bankers, Toronto, Ont., are offering $2,000,000 in 7% cumulative, sinking fund, convertible, first preference shares (par value $100) in the Canada Paving and Supply Co., Windsor, Ont., which has extensive sand and gravel producing facilities.

Recent Dividends Announced

American Brick Co. pfd. (qu.)	50c	Nov. 1
Consolidated Sand and Gravel pfd. (Can.) (qu.)	1¾%	Nov. 15
Material Service (qu.)	50c	Dec. 1
Standard Paving and Materials com. (Can.) (qu.)	50c	Nov. 15

Batesville White Lime Company Installs New Crushing Plant

By Tom Shiras
Mountain Home, Ark.

BY THE ADDITION of a crushing unit to its lime plant, the Batesville White Lime Co. of Batesville, Ark., has put itself in position to take care of all lime and stone requirements in its territory. The new crushing plant which was put into operation early in September is modern in every detail and involved an investment of approximately $100,000.

The products being produced by the new unit are both crushed and ground limestone. A considerable part of the crushed stone output has already been contracted to the Missouri Pacific Railroad, which has a ballasting program that will extend over a number of years.

The agricultural limestone being shipped is of exceptionally high quality, being produced from clean selected limestone of about 98% calcium carbonate content and is pulverized to pass a 20-mesh screen, making the material very readily soluble in the soil. The company is enjoying an excellent demand and already the tonnage has reached very considerable proportions.

Some limestone will be sold for chemical uses. At the present time the dairy industry in the south is undergoing a big development, and as ground limestone is essential to the production of clover and alfalfa in many parts of the south, the market is growing. The Batesville White Lime Co.'s plant, being located in the southern foothills of the Ozarks, and adjacent to the delta, puts the product close to place of consumption, which is very desirable both to the manufacturers and the consumers.

In locating the new unit the company used excellent judgment. The site chosen was at the end and to the rear of the lime plant proper, on the side of a hill. By taking advantage of this kind of a site, they were able to move the product in course of manufacture a considerable distance through the plant by gravity. The upper part of the plant is just a few feet below track level of their industrial railroad, over which the stone used is supplied. The loading spouts of the storage bin serve a Missouri Pacific siding to allow all loading for shipment to be done by gravity.

Because the product passes a considerable distance through the plant by gravity in course of manufacture, and the equipment is the most modern that could be purchased, the entire operation is practically automatic, requiring but little labor.

Stone is handled from the quarry, two miles distant, to the plant by a Davenport steam locomotive and two Whitcomb gasoline locomotives, in 5-yd., two-way Western dump cars. Twenty cars, or 100 yd., are handled at a trip, and when the plant is running at capacity a trip is made every hour. The stone goes direct from the cars into a 16-in. Allis-Chalmers gyratory crusher, in which the primary crushing is done. From this crusher the product goes by gravity into a 12-ft. revolving sizing screen in which it is sized. From this screen it travels three ways.

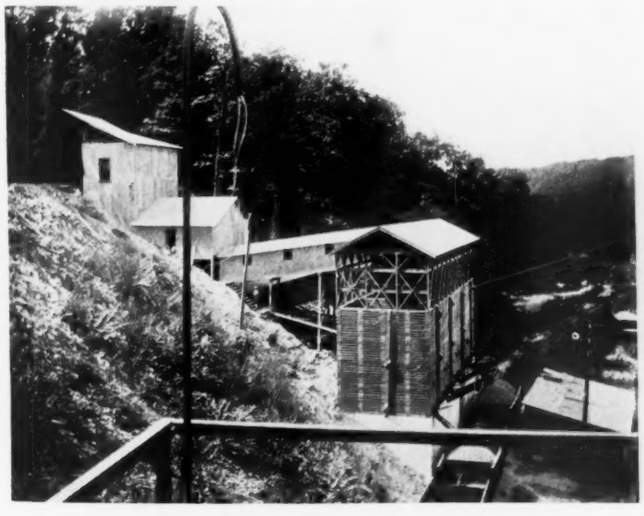
Everything from ½- to 2½-in. mesh goes to the storage bin for shipment.

Everything under ½-in. goes by gravity to a Williams hammer mill, where it is converted into ground limestone for agricultural and chemical uses.

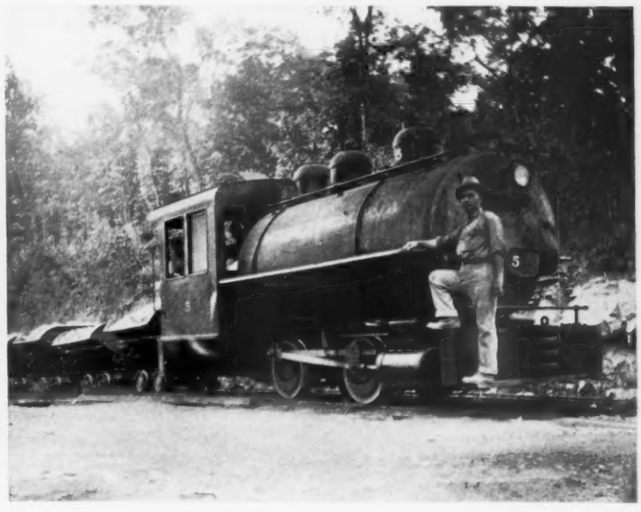
All oversize goes by gravity to a 10-in. Allis-Chalmers gyratory crusher for secondary crushing. The entire product from this operation goes by belt conveyor back to the sizing screen and is distributed as described in the first operation. Goodyear conveyor belting is used throughout the plant.

The limestone deposit has an average thickness of 135 ft., and underlies some 400 acres of the property. All the primary drilling at the quarry is done with a Keystone No. 4 well drill, equipped with 5⅝-in. bit. The secondary drilling is done with Sullivan and Gardner-Denver jackhammer drills, which are operated by air supplied by two compressors. One, a Chicago Pneumatic, and the other a portable Ingersoll-Rand.

Additional quarry equipment will be necessary in a short time, and the company is now figuring the requirements. The principal piece of new equipment that it will be necessary to install will be a 1¼-yd.



General view of the new limestone crushing plant, Batesville White Lime Co.



Steam locomotive hauling a train of quarry cars. Charles Teague, superintendent, is on the pilot

shovel, which will be used for car loading. The intention at the time this article was written was to purchase an electric shovel.

Each piece of equipment in the new crushing plant is driven by an individual motor, the same power scheme being carried out as is in use in the lime plant proper. Power is furnished the entire plant by the Arkansas Power and Light Co., from a high power line, which touches outlying Batesville.

The officers of the Batesville White Lime Co. are: George T. Weigart, president and general manager; L. E. Smith, assistant manager; C. B. Teagere, superintendent; Leo F. Smith, accountant. W. W. Fischer, of Memphis, Tenn., is chairman of the board of directors.

[The new lime plant of this company, completed in 1928, was described in Rock Products, November 24, 1928.—Editor.]

The Use of Manganese in Agriculture*

Dr. Oswald Schreiner

Chief, Division Soil Fertility, Bureau Chemistry and Soils, U. S. Department of Agriculture

THE USE of manganese in agriculture has been increased in the last few years as a result of some practical demonstrations with tomatoes and other truck crops in southern Florida. These demonstrations were based on research work by scientists of the U. S. Department of Agriculture which have been conducted over a period of years and tended to show that manganese was essential to plant growth, for without it plants showed abnormal symptoms, analagous to disease conditions.

As manganese is widely distributed throughout the United States, most soils contain sufficient for profitable crop production, but in certain sections where manganese is rare in rocks and soils, or where conditions are such that the manganese is unavailable to plants, serious difficulties are experienced.

A bad case in point is a region in southern Florida, where the soil consists largely of calcium carbonate with manganese practically absent. A chlorotic condition of the foliage of the plants showed itself in white spots on the leaf's surface with ultimate death of the plant. It was found that this difficulty could not be remedied with liberal applications of the ordinary fertilizer salts and for many years it was considered impossible to grow many of the vegetables on these lands. They were practically devoted to the growing of tomatoes with the use of liberal amounts of manure imported from other sections of the United States.

The scientists discovered the absence of manganese salts and also showed that the principal value of the manure lay not so much in its fertilizer constituents as in the fact that it contained the necessary manganese in available form for the plants grown on these deficient soils. Experiments with the use of small quantities of manganese (50 lb. of manganese sulphate per acre) remedied this difficulty entirely and produced vigorous plants, deep green in color, with luxuriant blossoming and greatly increased crop production, while without manganese many plants faded and died and the crop yield was tremendously reduced.

A number of large scale experiments were conducted with growers, using one acre plots to determine the effect of manganese sulphate. In these tests the cooperating farmers used and applied the material; some mixed it with the commercial fertilizers, others applied it as a separate application. All of these experiments showed a substantial increase resulting from the use of this salt. As a result of this manganese sulphate is now used throughout this region in the successful growing of vegetable crops.

Similar results have been obtained in other sections of the country and the importance of extending this experimental work to soil regions where crop difficulties are experienced is evident. Recent experiments have also shown that small quantities of other of the rarer elements are of tremendous importance in crop production and that in the modern use of fertilizers, especially in connection with the newly introduced chemical fertilizer salts, this must be considered.

*Paper read at the second annual convention of the American Manganese Producers Association, Washington, D. C., September 9 and 10.

Editor's Note

***THE INTEREST** in this article to most ROCK PRODUCTS readers is that some agricultural limestones and phosphate rocks may contain appreciable amounts of manganese. If they do, obviously they have an added value.*

Also pulverized blast-furnace slags have been and are being used to some extent as fertilizers. Many such slags contain appreciable amounts of manganese.

This information should therefore prove of value to producers of these materials, as well as producers of manganese ores.

—Editor.

Use of Lime in Fuel

IN THE PREPARATION of some oils for use as liquid fuel, thorough agitation with hydrated lime or with ground quicklime at 80 deg. C. is important, as it increases the stability of the oil and removes acid compounds which would corrode the burners. Instead of lime, the stabilization is sometimes effected by means of soaps made of lime and resin acids.

Lime is sometimes mixed with the resin or other binder used in the production of briquettes made of anthracite or other carbonaceous powders. It enables a smaller proportion of binder to be used, but the resulting increase in the ash left when the fuel is burned is sometimes regarded as objectionable.—*Stone Trade Journal* (Great Britain).

Domestic Graphite Sold in 1928

THE total quantity of graphite sold by graphite miners in the United States and its value were considerably larger than the corresponding figures for 1927 according to a statement by the United States Bureau of Mines, Department of Commerce. The following statistics of sales of graphite were collected in cooperation with the geological surveys of Alabama, Georgia, Michigan and Texas. The sales of natural graphite by producers in 1928 were 5611 short tons, valued at $297,093, an increase of 404 tons, or 8% in quantity, and $64,122, or 28%, compared with 1927. The increase in quantity of sales was chiefly in the amorphous variety, the crystalline variety increasing in quantity only slightly. The total sales included 2994 tons of amorphous and 2617 tons of crystalline graphite. This was an increase of 399 tons, or 15%, in the former, but only over 4 tons (8900 lb.), or 0.2%, in the latter. The value of the amorphous variety increased $7470, or 21%, and the crystalline variety increased in value $56,652, or 29%, compared with 1927. The quantity and value of crystalline graphite sold in 1928 were the largest since 1920.

The states reporting sales in 1928 were Alabama, Georgia, Michigan, Nevada, Rhode Island and Texas. Texas was the leading state in the sales of crystalline graphite in 1928.

The foregoing figures represent the sales of shipments of graphite. The production figures are somewhat different. Only one amorphous graphite mine was in operation in 1928, that of the Carson Black Lead Co. in Nevada. Two others made sales or used material from stock mined previously. The production of crystalline graphite in 1928 was 5,500,000 lb.

The imports of graphite in 1928 amounted to 17,569 short tons, valued at $801,559, compared with 17,452 short tons, valued at $723,933 in 1927, an increase of less than 1% in quantity and of 11% in value.

Second California Regional Safety Meeting

Was Held Under the Auspices of the Portland Cement Association at Los Angeles, September 24

THE second annual California safety meeting under the auspices of the Portland Cement Association was held at the Los Angeles Biltmore on September 24. Loren C. Barton, vice-president of the Riverside Cement Co., acted as general chairman: Wilford S. Trueblood, production manager of the Monolith Portland Cement Co., as afternoon chairman; L. V. Robinson, superintendent of the Southwestern Portland Cement Co., as toastmaster, and A. J. R. Curtis of the Portland Cement Association as secretary.

There were present over 80 representatives of the following companies, many of them with their wives: Calaveras Portland Cement Co., San Andreas; Cowell Portland Cement Co., Cowell; Monolith Portland Cement Co., Monolith; Pacific Portland Cement Co., Redwood City and San Juan Bautista; Riverside Cement Co., Crestmore; Santa Cruz Portland Cement Co., Davenport; Southwestern Portland Cement Co., Victorville; Yosemite Portland Cement Corp., Merced.

Opening Session

Chairman Barton opened the meeting with a few words indicating its purpose.

As the first speaker Mr. Barton introduced A. J. R. Curtis of Chicago, who was invited to outline the recent progress of safety work in the cement industry. Mr. Curtis said:

This is the 13th of our 14 regional meetings scheduled for this year. These meetings have been very helpful and when the series is completed the attendance will have reached nearly 2000. This 2000 out of some 42,000 engaged in the mills constitute a sort of aristocracy—men picked for the job of putting safety across in this industry.

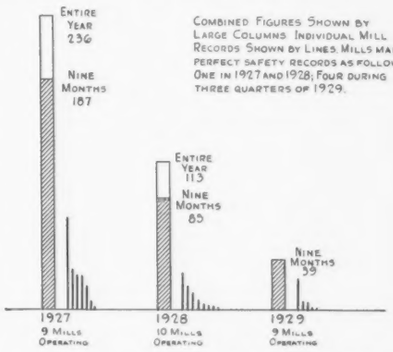
We come here, for one thing, to get viewpoint. The executive who plans ahead five or ten years has it; some of us plan ahead about two hours. Viewpoint will help us to see just where each one of us fits into the picture and give us a proper sense of responsibility toward our work. We are here also that we may acquire more specific information about avoiding accidents. This we will succeed in if each one will contribute from his own store of experience.

The third thing we hope to do at this meeting is to recharge ourselves with enthusiasm. Above all things, we must not lose the precious gift of enthusiasm with which most of us are endowed as young men. At 40 or 45 there is a danger that enthusiasm may begin to lag a bit. We must resist any such tendency and seek means such as this meeting to replenish our supply.

An opportunity to keep in touch with the accident prevention work of our industry and a responsibility to study the current accident reports has given me the impression that there is now hardly a plant in the country that does not have at least a nucleus of men who know how to go about the task of preventing accidents. The essential points are well understood. But we are generally hindered by a lack of the necessary thoroughness in carrying out our plans. We know what is needed and what methods to use, but we perform very ineffectively.

Reports come to us from men who write about as sparingly and as meaninglessly as would be possible in order to dispose of the painful report and send it in. Such procedure hinders our progress immeasurably. But the man who fills in the report fully and intelligently, trying to add, wherever possible, something that will help others to avoid the same pitfalls, is performing the greatest service to the entire industry as well as his own mill. The intelligent report must be preceded by a searching and exhaustive investigation. The report should not be considered complete until there has been discovered a way to avoid that same accident in the future and the necessary precautions have been taken, whether they involve a personnel or a mechanical problem or a combination of both.

With proficient and painstaking investigators on the job in every plant, it should not be difficult to get the facts about these accidents and relay them frequently to every superintendent, foreman and responsible workman.


Entire Year 230
Nine Months 187
Entire Year 113
Nine Months 85
Nine Months 39
Combined Figures Shown by Large Columns. Individual Mill Records Shown by Lines. Mills Made Perfect Safety Records as Follows One in 1927 and 1928; Four during Three Quarters of 1929.
1927 9 Mills Operating
1928 10 Mills Operating
1929 9 Mills Operating

Accident frequency in California cement mills

There is a great deal to getting the proper viewpoint, as I said a few moments ago, and in closing I want to call your attention to this point by means of illustration. Should we report a total of 3000 recordable accidents in 1929 those of our men who are familiar with recent progress, would consider this a terrible record. Five years ago, however, when we had over 3000 lost time accidents and over 60 fatalities, the safety work of our industry was highly praised. Five years has made a great difference in our viewpoint. In 1927 we had less than 1400 recordable accidents and in 1928 a few over 1000 counting all kinds. Consequently, 3000 in 1929 would be intolerable, unthinkable, and as we become more enlightened, our

Second California regional safety meeting dinner, Hotel Biltmore, Los Angeles, Calif.

viewpoint will keep changing for the better.

I am sorry there is a dark side to our picture. Possibly our record has led us to believe we are so good that we do not need to be as careful or as thorough as formerly. In 1928 we had 10% more fatal accidents than in 1927. In eight months of 1929 we had 68% more fatals than during eight months of 1928. The reason is undoubtedly lack of thoroughness in accident prevention work and the remedy will be found in careful study, searching investigation and real interest and attention by the management. Almost every accident produces one or a number of excuses or alibis—not a one, however, which would be of any help in avoiding recurrences. Show me a foreman who spurns the alibi and shoulders full responsibility for what goes on and I will show you a man who is moving toward the head of the industry.

Chairman Barton then said: "It is terrible that there should be so many fatalities in our industry. The executives of these mills are particularly anxious about these things. They don't want any employe to take a chance. None of our executives are indifferent. They want to cooperate and do everything they can with the men to prevent accidents. If they do these things it is against instructions to begin with, and out of pure carelessness or disobedience. We don't want in our mills anybody who is continually careless, for such a person is a menace to faithful and careful workers whose protection comes first."

The next paper on the program, entitled "Before and After Safety Training," by H. Sergeant, safety director of the Southwestern Portland Cement Company, will be published in full in a later issue and is, therefore, omitted at this time.

Superintendent Barnett's Remarks

Chairman Barton called upon E. D. Barnett, superintendent of the Cowell mill, to explain the secret of the fine accident record by that plant.

Mr. Barnett said in part:

The best recipe for obtaining a perfect record is just to go our after it with determination. Outside the element of luck, it's the hard grind, plugging along from day to day, getting everybody to cooperate from the owners down to the office boy, that counts. We have the idea of working together and as a result we have gone since May 11, 1926, without loss of time, which I believe makes this 1042 days of continuous accident-free operation.

I have read quite a few schemes for safety organizations, most of which seem to provide a super-abundance of committees and chairmen, and there is doubt in my mind as to who actually does the safety work with as much opportunity for buck-passing. We have an entirely different system at Cowell. It corresponds more to a military system in which a man is given responsibility and also authority. The head of our organization is Mr. George, who is secretary and general manager. Under him is the superintendent; under the superintendent are the foremen; under the foremen are the men in their departments. If you were to ask any man on the job, "Who is the chairman of your safety committee?" he couldn't tell you, because we haven't any. We haven't any group

E. D. Barnett

of men passing from one department to another, looking around to see what they can find out of place here or wrong there—we haven't any at all, but every foreman is held directly responsible for his own department; safety work is simply part of his job.

Placing the Responsibility

If a man is held absolutely responsible for the operation of his own department, he doesn't have any buck-passing or alibi. For instance, if you have a committee going into the machine shop from some outside department, they are there just a short time and they don't know much about the machine shop to start in with. Mr. Dermody, the foreman, has been in that machine shop probably 15 years, and knows everything in it and the history back of it. How in the world could an inspection committee coming in for a few minutes tell Mr. Dermody how to run his machine shop? About the first thing that would happen, knowing Mr. Dermody as I do, the committee would probably be thrown out of the door. We hold Mr. Dermody responsible for the operation of the shop, the safety of its men and everything concerned with it. He goes out of his way, as a matter of personal pride, to run the shop without accidents. This is just an illustration.

The whole organization is run in exactly the same way. This eliminates any chance of evading responsibility. I believe when you give a man responsibility, also give him authority; the two go in together.

At the conclusion of Mr. Barnett's talk, A. S. Bilderback, safety engineer for the Riverside Cement Co., said: "Evidently your system was inaugurated with the idea that each one can only work successfully for one boss. It would be hard for men to work for two bosses. Is that the idea?" Mr. Barnett replied in the affirmative.

L. V. Robinson, superintendent of the Southwestern Portland Cement Co.'s plant at Victorville, said:

"I agree with Mr. Barnett that the stopping of accidents must commence with the head of the organization—with the president or chairman of the board, then passing, as Mr. Barnett says, through a military organization down the line to the yard gang. The department heads should have sole responsibility for accidents in their departments.

"The movement starts from the company head but those in direct charge of the workmen are those who have the last word. A foreman should treat his men at least as well as he would treat his machine. Many foremen are very careful of their machines, keeping them well oiled, trimmed and wiped up and in perfect running condition. The men should come first and no one should take it for granted that they can take care of themselves. Foremen must realize their responsibility to the men under them and that the latter are not trained men like the foremen.

"I disagree with Mr. Barnett in this slight particular. It is physically impossible for a foreman to watch his men every minute: therefore, every man in the organization has got to be on his own to a considerable extent. A man must be trained to look out for himself while at work on his own specific work. So there is an awful lot in training safe workmen."

W. J. Dermody's Experiences

The next speaker was W. J. Dermody, master mechanic and captain of the first aid team at the Cowell plant. Mr. Dermody, who was also a delegate of the Cowell organization to the meeting of the Portland Cement Association at New York last May, said: "Today you can go out and talk safety and teach first aid with the hearty approval of the general manager. I remember the time when, if you wanted to talk safety first, you had to do it in the back room of a saloon and be careful to whom you were talking, or you'd have no job in the morning.

W. J. Dermody

"Some of you men may take safety work as something of a joke. I want to tell you that it is not. I devote about four hours per week 10 months of the year training first aid men in our little town of Cowell. I also want to tell you that I do that on my own time. I find that the men who take first aid are better workers for the company than those who refuse to take it."

Methods at Calaveras Plant

S. J. Lockwood, quarry superintendent of the Calaveras Cement Co., was then called

L. V. Robinson

upon. He said in part: "Each department at our plant is controlled entirely by the department head. We have our regular safety meetings and we have the question box. Our men are encouraged to put their questions and suggestions in the box for the attention of the safety committee. When a suggestion is found that is worthy of action, a letter of merit is posted on the bulletin board so that the writer may know. Merit marks are awarded for excellence in these suggestions and the marks are rewarded with trips, such as the trip to this meeting.

"Mr. Cadman, the inspector for the Federal Insurance Co., inspected us six months ago and put us down as a 100% safety plant. So far this year we have had no accidents to cause loss of time either in the quarry or in the plant and we are strongly desirous of maintaining our record."

F. F. Parker, superintendent of the Pacific Portland Cement Co.'s plant at San Juan Bautista, then spoke as follows: "My first experiences in the cement business were in 1891 with the Alpha plant in New Jersey, which was originally known as the Whittaker. I have seen safety work grow and know how meager it was in the early days as compared with now. The large amount of hand labor in those earlier mills naturally produced more accidents and I am sorry to say that they were very common.

"The main reason was lack of education. There were few guards and it was a case of every man for himself. My first safety lesson occurred while I was an oiler. There was a place where it was necessary to step over a couple of counter-drives with the oil line running overhead. I was accustomed to taking hold of the latter and jumping over the two drives to the next platform. One day Mr. Whittaker, the president of the company, was standing in the doorway and saw me do this. He immediately called me down and said: 'Partner, don't do that again. Life is worth more than any machinery we have here.'

"Naturally, that lesson, received as a kid, has stayed with me. We have done very well during the last year and a half at the San Juan plant, but we still have minor accidents. During the last 28 months about 411 suggestions were turned in and every one of them had a mechanical turn rather than ideas for educating the men away from accidents.

"We have thought of many ways to interest men but we don't always get it over. Speakers from the outside, we all know, have more effect, even if they say the same things we have in mind. I think interchanges between groups of plants reasonably close together help a great deal."

At the conclusion of the morning session informal lunch was served in the gold room, with a very enjoyable musical program and dancing.

Afternoon Session

Chairman Barton introduced Wilford S. Trueblood, production manager of the Monolith Portland Cement Co., who presided during the afternoon session. The first speaker of the afternoon was Sam Haver, manager of the employment department of the Southern California Edison Co., whose address was on the subject of "Electrical Hazards." Mr. Haver said in part:

"In approaching the subject of electrical hazards we run into the matter of plant installation. In bringing in service wires, proper clearance should always be provided. Next in importance to installation and maintenance is the matter of overloading circuits and apparatus. This not only reduces the efficiency but frequently causes damage to the apparatus of the property. To take care of these things every plant should have periodic inspection by a competent inspector. Nothing should be installed in such an inaccessible place that it is likely to be forgotten and the inspection should be complete and thorough from the service wires to the final apparatus that is being operated."

"The Yardstick of Safety"

A. S. Bilderback, safety engineer of the Riverside Cement Co., then spoke as follows on "The Yardstick of Safety":

We have three ways of measuring safety progress; one, accident frequency rate, one accident severity rate, and then turning to the insurance companies, we find their insurance loss ratio figures. There is one big weakness in handling accidents. A man who is off for one day only is counted as one accident just the same as a fatality. So we begin measuring our accident severity as well. We take the total time lost by these men, reduce that to a common denominator, 100,000 man hours, and then we get a new figure which shows the amount of time in number of days lost for every 100,000 man hours worked.

F. F. Parker

There is also some question about this figure. The question arises whether we shall work a man at little different jobs until he is able to return to his former employment or whether we shall continue to lay him off until he can return to his regular place. Those of us who were at the San Francisco meeting will remember the excellent discussion on that point, and I believe I can venture the opinion that every one of us went home with exactly the same idea about the matter that we went there with. Our trouble is probably that we have a method of measuring accident progress which cannot include all company policies. Every company has a right to handle this question as it sees fit.

Cost Basis for Accidents

In every company, somebody, whether that man is general manager or the secretary or the head of the insurance department or the head of the personnel department, has to get these accidents down to a question of dollars and cents. We have three ways of looking at accidents from the dollars and cents standpoint. The first one is by means of the common figure used by insurance companies, loss ratios. They take in that figure the amount of money which they spend each year, divide it by the premiums which they have collected and that represents the loss ratio. In our industry we have got two other sets of figures, one, cost per barrel of cement; the other, cost of $100 pay roll expenditure. The question of insurance loss ratios, I personally would lay aside because it is a figure that ultimately has to come down to pay roll anyhow. The question of cost per barrel of cement is a very small figure and might not be quite as interesting as the third, cost per $100 pay roll expenditure. As an example: If we operated for a given time, and spent $385 and our pay roll was $100,000, the cost would be 38½ cents per $100 pay roll expenditure. This is a figure very susceptible to fluctuation, but seems to show instantly whether you are going up or going down. I suggest that we seriously consider in this association placing our accidents on a cost basis in order to see what that will show us.

It is not my purpose to talk here about the details but will pass them over and with

your permission we will consider whether we can gain anything by tying in the dollar and cents proposition in this accident program. Then, of course, if the thing looks worth while, it would be possible to investigate the other details.

The first benefit that I believe would accrue to the safety movement would be direct from company management. It was truly said here this morning by one of our speakers that the safety movement percolates from the top down. If you want to see a lot of wasted effort, watch a bunch of men struggle on the safety question unless the management is 100% behind them. This safety question has been placed before the management on the basis of number of accidents and days lost. Those are definite figures, but I feel safe in saying that our managers are not always sure when they pick up those figures whether they represent a bad case or a good one. Is a general manager embarrassed in that way when he studies any other phase of industrial activity? Can you men imagine an executive sitting quietly and checking month after month clinker grinding costs three times those of his competitor? You know there would be something done about it. Can you imagine one of our executives content with the fact that he pays accident losses clear out of line with all the rest of the companies that are operating exactly as he is?

Finding the "Why" of Accidents

What we should do is hand this accident question to our chief executive in the simplest language that industry knows, which is cost; if the cost of accidents this month is over last month's cost, that figure will be noted, and down through the channels of the organization will come the inquiry from the big boss as to why. You can't answer questions as to why right off hand. Therefore, there would be a good many investigations made as to why these accidents happen. These investigations would, very probably, uncover a lot of things which we have overlooked or which, for some reason, have just been going on, not because we wanted them to but because we have not noticed them. I believe I can venture to predict that when the day comes on which we can hand to our managers the story of this accident question in a language which is understood by all concerned, the problem of the cement association of severe accidents and fatalities increasing, will no longer exist.

At the conclusion of his remarks Mr. Bilderback, substituting for J. W. Harrington of the Bureau of Mines, who was unable to attend, conducted an interesting first aid demonstration with the assistance of a group of trained first aid workers from the various cement plants represented.

General Discussion

The following are brief notes on the general discussion which followed the first aid demonstration:

P. Anthony, Southwestern Portland Cement Co.): "Eye injuries are the most frequent we have in our plant. The workers complain of the goggles made with a hard frame which allow dust to come down around the bridge of the nose and into the eyes. A soft rubber framed goggle has helped us very much to avoid dust in the eyes. Defective tools also cause minor accidents. Mushroom heads will be avoided by all good mechanics. Also, we are learning to beware of wrenches which do not properly fit the bolt or nut. They are dangerous. A sledge hammer handle of proper length for the work is very important."

George Hunter (Riverside Cement Co.): "We are successfully using a small leather goggle with a lining on the outside."

Use of Steel Helmets

L. R. Mills (Riverside Cement Co.): "We had an accident in which a small piece of rock struck a man in the quarry and since that time we have introduced 'hard boiled' helmets which protect the head effectively and are now worn by all of our quarry workers as a protection against falling rock."

C. A. Forester (Monolith Portland Cement Co.): "In regard to the hard boiled hats. Some time ago in the quarry we had two accidents—in one a man received two skull fractures, while the second was not so severe. They scared me to the extent that I immediately ordered a dozen hard boiled hats, and I will say that since we have been using them we have had no trouble. Working under a loose bank, we have lots of small rock falling down. I was enthused by the demonstration given a little while ago, and as soon as I get back home I intend to organize a team in our quarry and see if next year we cannot put on that little demonstration ourselves."

Frank Arnold (Southwestern Portland Cement Co.): "It is very important in the quarry that we have men who have been in the game long enough to clean the banks before they get under them. Many men are too indifferent around powder. I have seen men with tamping tools perhaps having two men put all their weight onto that powder, driving it into the hole. You might ask them, 'If you were to put that cap in there and set a fuse to it, what would happen?' 'Why,' he would say, 'it would blow out.' 'Well,' you would say, 'then supposing when you are ramming that powder in there you would create a spark at the time that you jarred that powder; then you are creating or duplicating the action of that cap.' Now, that is a thing that is worthy to consider, and there have been a lot of premature accidents happen that way."

H. T. Black (Southwestern Portland Cement Co.): "When a packer gets a shot of cement in the eye, we immediately drop in castor oil and take him to a doctor who cleans his eye out. This treatment results in the man being back at work in a couple of hours without any ill effects."

REGISTRATION

Calaveras Cement Co., San Andreas, Calif.
Sam J. Lockwood, quarry superintendent.
Paul Bischoff, chemist.
L. J. De Martini, clerk.
Harry Fisher, packhouse foreman.
B. E. Neal, boiler maker.
W. D. Rankin, general foreman.
David Wheeler, engineer.
James R. Casey, timekeeper.

Cowell Portland Cement Co., Cowell, Calif.
E. D. Barnett and wife, superintendent.
W. J. Dermody and wife, machine shop foreman.

Monolith Portland Cement Co., Monolith, Calif.
Wilford S. Trueblood, production manager.
C. A. Forester, quarry foreman.
R. F. Griffin, foreman shipping department.
J. M. Hornburger, Jr., builder.
J. M. Low, foreman.
T. W. Torgerson and wife, chief electrician.
Clarence W. Watson, chief chemist.
Carleton T. West, engineer.

Pacific Portland Cement Co., Redwood City, Calif.
M. J. Johnsson, superintendent.
H. Haruff, general foreman.
H. Stephens, master mechanic.

Pacific Portland Cement Co., San Juan Bautista, Calif.
A. E. Castano, safety inspector.
Henry Jacoby, chief electrician.
F. C. Neil, master mechanic.
F. F. Parker, superintendent.

Riverside Portland Cement Co., Riverside, Calif.
Loren C. Barton, vice-president.
Garner A. Beckett, general manager.
A. B. Allcham, foreman machine shop.
M. Atchliff and wife, shift foreman.
R. E. Bauer and wife, shipping clerk.
F. Brockamp and wife, treater foreman.
Alex S. Bilderback, safety engineer.
H. Christensen and wife, repair foreman.
Harry L. Garver and wife, carpenter foreman.
R. C. Hatch and wife, electrician.
George Hunter, waste heat department.
W. R. Lend and wife, molder.
Christie Miller and wife, boiler foreman.
L. R. Mills and wife, safety supervisor.
Thomas F. Mullan, chief chemist.
R. D. Sanders and wife, foreman raw mill.
J. R. Smith, welder foreman.
Frank Starr and wife, yard foreman.

Santa Cruz Portland Cement Co., Davenport, Calif.
Joseph Riordan and wife, assistant superintendent.
Robert Banigar, quarryman.
D. S. Carpenter, mill foreman.
L. E. Davis, electrician.
L. R. Davis, quarry superintendent.
G. M. Frykland, chemist.
C. M. Hargraves, storeroom clerk.
James C. Lenter, quarryman.
T. P. Williams and wife, bookkeeper.

Southwestern Portland Cement Co., Victorville, Calif.
L. V. Robinson and wife, superintendent.
Harry Sergeant and wife, safety engineer.
Geo. F. Adams, head burner.
P. Anthony and wife, chairman, workmen's committee.
Frank Arnold, quarry superintendent.
W. E. Bell, head miller.
H. T. Black, electrician.
M. M. Black, shipping foreman.
J. C. Cleveland, storekeeper.
C. B. Core and wife, chief chemist.
P. A. Ellis and wife, crusher foreman.
R. A. Galbraith, railroad foreman
Bert Haruff and wife, general foreman.
F. Johanson and wife, construction foreman.
W. E. Robinson and wife, master mechanic.
N. S. Weiss and wife, slurry dept. foreman.
R. M. Willson and wife, chief chemist.

Yosemite Portland Cement Corp., Merced, Calif.
Geo. A. Fisher, general manager.
Alphonse P. De Jonckheare, superintendent.
S. C. Pierce, asst. chief chemist.

Others
A. J. R. Curtis, assistant to general manager, Portland Cement Association, Chicago.
A. R. Foster, purchasing agent, California Portland Cement Co., Los Angeles.
S. C. Haver, Jr., safety engineer, Southern California Edison Co., Los Angeles
A. MacWilliams, local representative, Hercules Powder Co., Los Angeles.
Amos H. Potts, district engineer, Portland Cement Association, Los Angeles.
R. M. Wood, manager, department of personnel, Standard Oil Co., and president, California Society of Safety Engineers, Los Angeles.

Maromas Company Making Stone Deliveries

THE CONNECTICUT River Stone Products Co., which reopened the granite quarries in Maromas, Conn., several months ago, began recently making deliveries of crushed stone. The past few months the concern has been busy installing the necessary machinery which includes a large crusher. The company will build a new road around Bagley hill so as to cut out the high grade for hauling stone on the river road.—*Maromas (Conn.) Press.*

Effect of a Bonus on the Accident Record of the Southwestern Portland Cement Company*

By Emory Smith

First-Aid Miner, U. S. Bureau of Mines, Mine Safety Station, Berkeley, Calif.

THE VICTORVILLE plant of the Southwestern Portland Cement Co. is modern and well kept, as the officials, especially the higher operating officials, take pride in the appearance of the place. Dust has been practically eliminated by the installation of dust collectors and wet grinding. The plant has a rated capacity of 6,000 bbl. of cement daily.

The quarries are located on the Mojave Desert about 7 miles from Victorville and are reached by the Mojave Northern Railroad. The cement plant, quarries, and railroad are all owned and operated by the same company, which employs from 270 to 300 men in all operations. The plant has been in service since 1916. Machinery and equipment are modern, well guarded, and maintained in good condition. Electric power, purchased from the Southern Sierras Power Co., is used throughout the plant.

Company Long Interested in Safety

This company has long been interested in safety and has for several years been trying to reduce the number of lost-time accidents. According to available records, the first safety committee was organized in 1921, and the first committee meeting was held on September 15 of that year. The original committee was composed exclusively of foremen and other company officials, and this policy of membership was followed for some years.

This safety committee, composed exclusively of company officials, had the advantage of being practically an executive body with the necessary authority to act without delay or interference but suffered the disadvantage of viewing the accident prevention work entirely from the executive angle. Moreover, when the safety committee is composed of officials only, it is likely to give rise to the attitude among the workingmen that safety is a matter of concern to officials only.

The disadvantages of the system so far outweighed the advantages that in March, 1928, it was superseded by the present method of selecting the members of the safety committee from among the workingmen about the plant. One man, with the consent of his foreman, is now chosen from each of the 16 departments of the plant and serves for six months on the safety committee without extra pay. In order always to have experienced men at the meetings, the periods of service are so arranged that half of the committee changes membership every three months. While foremen and other officials may attend safety meetings and make suggestions, they are not allowed to serve on the safety committee. Meetings are held on the last Friday of each month and the minutes are sent to the superintendent's office for consideration at the regular foreman's meeting on the following morning.

One man is selected from the safety committee to act as a safety inspector about the plant. Each department is represented by one member of the committee, and each member is supposed to pay particular attention to his own department, with which he is familiar, and immediately correct or report to his foreman any condition or practice which he may regard as unsafe.

Complete Records Kept

Records of the original safety committee meeting of September 15, 1921, and all subsequent monthly meetings have been typed and filed in a loose-leaf ledger; this complete set of minutes is open for inspection of every employe of the company. Examination of this interesting record of activities shows to what extent the company supported the committee. To April, 1929, the record shows that 128 recommendations were submitted by the committee, and of these, 122 were carried out in all respects, 5 were partially completed, and only 1 rejected. These recommendations covered practically everything under safety and welfare, from broken rails in the yard track to broken dishes in the boarding house.

In spite of all efforts, however, the accident record did not react in the manner in which the company officials believed it should, and it was decided to supplement other activities with a bonus system. In order to make a fair system the men were arranged in ten "teams," so grouped as to equalize the hazard as far as possible. From 25 to 30 men compose a "team" and any team completing a month without lost time due to an industrial accident is given a bonus of 1% of their monthly pay. In case an accident occurs, however, the "team" of which the victim is a member does not receive a bonus for any month during which the accident causes a loss of time.

The result of the bonus system was both surprising and gratifying from the start. Since it was inaugurated in May, 1928, only two teams have failed to receive a bonus for every month, and for 12 consecutive months there has not been a lost time accident and no time has been lost due to previous accidents. Following is a list of months showing the number of hours lost per 1,000 man hours worked since January, 1925.

HOURS OF LOST TIME PER 1000 MAN HOURS WORKED SINCE JANUARY, 1925

	1925	1926	1927	1928	1929
January	4.075	1.767	2.745	None	None
February	3.927	6.298	4.940	0.129	None
March	4.713	4.102	6.950	3.409	None
April	4.706	5.581	12.047	4.109	None
May	4.457	3.490	5.650	*4.132	None
June	3.437	3.498	4.880	3.480	None
July	9.623	7.899	0.139	2.254	None
August	6.490	4.343	2.730	None	.....
September	3.722	3.622	5.690	None	.....
October	7.924	4.651	8.740	None	.....
November	5.448	5.132	2.750	None	.....
December	4.388	11.400	3.094	None	.....

*Bonus system started May, 1928

It is quite generally believed by both men and management that the bonus system is responsible for this reduction of accidents, as prior to the introduction of the bonus there had been only one month free from lost time in 12 years of operation.

Cost of Bonus System

Costs of the bonus could not be compared directly to costs of hospitalization, compensation, etc., but the following excerpt from a letter written by the chairman of the safety committee would indicate that the cost of the bonus system is considerably less than the cost of accidents:

"The average cost of safety is approximately one-third of what increased insurance would be, did we not have our present safety activities, training, education, guards, etc."

Extensive use is made of the bulletin board and interesting pictorial news is shown in addition to the regular safety posters, in order to attract wider and more favorable attention.

At the beginning of the present year a bulletin board was erected to show lost-time accidents, the department suffering the accident, and the month in which the accidents occurred. On this board is painted the outline of a flag which is di-

*Reprinted from U. S. Bureau of Mines Information Circular No. 6176.

vided into 12 columns, each of the columns containing 16 blocks. The 12 columns correspond to the 12 months of the year, and each of the blocks represents one of the 16 departments of the plant. A cross is outlined at the center of the flag and the whole is painted a neutral color. At the end of each month the monthly column is painted and a color scheme is followed which at the end of the year will have the board painted with a green field and a white cross of the "no-accident" flag of the Portland Cement Association. However, should a lost-time accident occur, the block representing the department in which it occurred will be painted red for each month during which there is lost time.

System Gives Results

That those in charge of this plant are making effective their efforts and methods toward prevention of accidents is very well shown in the foregoing tabulation which indicates that starting with August, 1928, this entire plant, employing upwards of 250 men, did not have a lost-time accident up to and including July, 1929—a full 12 month period.

While the month by month record as to hours lost time by accidents per 1,000 man hours worked, shown in the tabulation, indicates that for the years 1925, 1926, 1927, and the first half of 1928, the record was uniformly good, nevertheless the ultimate goal of no lost-time accidents was not reached until August, 1928.

An inspection of the table almost forces the conclusion that the institution of the bonus system in May, 1928, was the final refinement in the accident prevention practices of this plant which "put over" the no-lost-time accident program; 4.132 hours lost per 1,000 man hours worked in May, 1928, the month of the institution of the bonus system, was not far from the general month by month average of the three previous years; yet on the second month the bonus was in effect, the number of hours lost by accident per 1,000 man hours worked dropped to 3.480, in the next month it dropped to 2.254, and in every succeeding month (from July, 1928 to August, 1929) the plant worked without lost-time accidents.

Combined Efforts Make a "Safe" Plant

Possibly with the bonus system credit should also be given the change from the all-official safety committee system to the all-employe safety committee system made effective in March, 1928. In any event the excellent record of 12 months without a lost-time accident, in a plant involving the utilization of the services of 270 to 300 men, could be accomplished only through the combined effort not only of the safety committees and of each and every one of the individual workers of the plant, but also of the intelligent, sympathetic co-operation and direct supervision of the employers' representatives.

Arrow Company To Straighten Scioto River

THE ARROW Sand and Gravel Co., Columbus, Ohio, has agreed to turn over to the city of Columbus the land which lies west of the Big Four railroad, south of Dublin road and north and east of the Scioto river between the waterworks dam and the Big Four railroad bridge, on or before January 1, 1935.

In return for this the city grants the gravel concern permission to straighten the Scioto river bed and to remove gravel from the old river bed.

In the exchange of leases the city eventually will secure 24.78 acres of land south of Dublin road opposite the municipal golf course for a city lake. The action was ratified in legislation passed by the city council recently.—*Columbus* (Ohio) *Dispatch.*

Southwestern Portland Fetes Modernization of El Paso Cement Mill

IN celebration of the completion of additions and the installation of new machinery in its plant at El Paso, Tex., at a cost of $250,000, officials of the Southwestern Portland Cement Co. gave a barbecue on the night of October 22 with more than 200 guests in attendance. Mayor R. E. Thomason was one of the honor guests. With its new natural gas burners, and other modern equipment, the plant is now considered one of the most up-to-date cement manufacturing plants in this country.

Guests were escorted through the plant by W. R. Blair, sales manager, and other officials and were permitted to witness the cement manufacturing processes. Barbecued beef and pork, cheese, potato salad, olives, celery, jam, coffee, cigars and cigarets were served.

To Develop Canadian Diatomite Deposits

THE big deposit of diatomite near Quesnel, B. C., consisting of 323 acres, is to be put under development by the Canada Diatomite, Limited. The Victoria, B. C., members of the company are G. A. C. Cox, J. A. Kenning, E. H. Groos and E. O. Weston. William A. Laming, technical engineer and industrial chemist of Holland, who has had the properties under examination, has accepted the post of managing director.

"The company will quarry the diatomite, white ball clay and kaolin from the quarries at Quesnel and transport the material to a plant to be erected in Victoria, where it will be ground and otherwise treated for use in Canada and for the big export market in Europe," Mr. Laming said. "The company will also handle the talc shell and other products."

The Quesnel deposit beds are from 30 to 60 ft. thick, and have been tested out with test holes and are claimed to be the largest diatomite deposits yet found in Canada.—*Victoria* (B. C.) *Times.*

Silicate of Soda Plant to Be Built at Baltimore, Md.

THE Industrial Bureau of the Baltimore Association of Commerce announces that the Philadelphia Quartz Co. will build a plant here for the manufacture of silicate of soda. This company will shortly celebrate its 100th anniversary. It was established in Philadelphia in 1831 and is the oldest and largest producer of silicate of soda.

This chemical, perhaps most familiar as a means for preserving eggs, has many other important uses in industry. It is the adhesive used in making corrugated and fibre boxes for parcel post and freight shipments. It has valuable washing properties and is widely used in laundry soaps. It is one of the raw materials for the most efficient known water softener, called "Doucil," and it is a valuable means for controlling rusty water in the home or in the city supply. A special form serves as a hardener for concrete roads and still others to make cements for resisting acids and other needs of chemical manufacturing.

The company's general office is located at Philadelphia, Penn., and it now has factories at Rahway, N. J., Chester, Penn., Gardenville, N. Y., Anderson, Ind., Kansas City, Kan., St. Louis, Mo., Utica, Ill., and the Philadelphia Quartz Co. of California, Berkeley, Calif.

The Baltimore plant will be located at Fort avenue and Decatur street and will be served by the Baltimore and Ohio Railroad.

Worker Killed at Lima Quarry

GUY A. SWARNER, 33, father of seven children, died in City hospital, Lima, Ohio, on October 18 of injuries received when he was crushed between stone cars in the pit of the Lima Stone Co., where he was employed. His left leg was crushed. Fellow workmen fashioned a tourniquet from a handkerchief in an effort to check the blood until he was removed to the hospital. However, he was nearly dead from loss of blood when taken from the ambulance.—*Toledo* (Ohio) *News-Bee.*

Cement Company to Develop Washington Gravel Properties

ACCORDING to the *Vashon* (Wash.) *News-Record,* a cement company at Seattle (name not given) has completed plans for the construction of a dock, gravel and sand bunkers and the installation of washing and screening machinery on the property formerly owned by the old Vashon Sand and Gravel Co., about three miles south of Portage on Maury Island. Preliminary work has already begun.

The report states that this company has secured options on the Martindale property and other land in that section, in all about 80 acres, extending from the waterfront to Road No. 274, Maury Center, and has signed up with the Puget Sound Power and Light Co. for 600 hp. of electric power.

It is expected that sand and gravel will be loaded directly for delivery to any point along the coast.

The old Vashon Sand and Gravel Co. existed about 20 years and due to financial difficulties abandoned operations.

Ocala Company Building 2000-Ton Per Day Crushing Plant

THE Ocala Lime Rock Corp. has started construction of a lime rock crushing plant at Haile, Fla., on the Atlantic Coast Line railway similar to the one now being operated on the Dixie highway just north of Ocala. The Haile plant is being erected on property purchased in 1925.

Grading is already completed on a mile of spur track connecting operation with the A. C. L. near Haile. Machinery and plant timber are being shipped to the location now. When completed, the plant will have a daily capacity of 2000 tons. Two large steam shovels will be used in the quarry.

The operation will be under the direct supervision of Carl G. Rose, vice-president and general manager, and W. N. Horne, secretary-treasurer of the company.

Actual shipments of road material will start December 1.—*Gainesville* (Fla.) *Sun.*

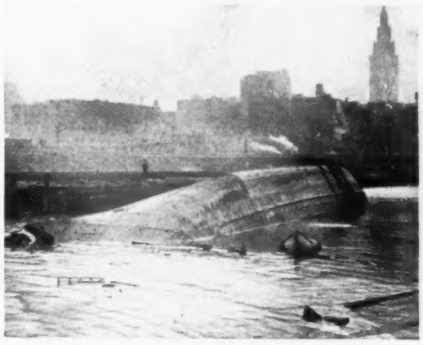
Arkansas Gravel Company's New Plant in Production

THE new $75,000 gravel plant just completed on the west bank of the Ouachita river, just outside the Arkadelphia city limits, is now functioning. This plant, called the Arkansas Sand and Gravel Co., is a subsidiary of the Tennessee-Arkansas Sand and Gravel Co., which has headquarters at Arkansas City and has taken the place of the Arkadelphia Gravel Co., using part of its equipment. C. C. Hawkins is president and C. E. Hawkins, manager. Shipments have a range to northern Louisiana on the south, Texarkana on the southwest and west, Pine Bluff and Benton east and northeast.

The new plant, situated 25 ft. above water level, has a 30-car per day capacity. It is operated entirely by electricity, about 500 hp. being required, of which 300 hp. is for the dredge boat working in the river about 200 ft. from the plant. The boat has a 10-in. manganese steel dredge pump.—*Arkadelphia* (Ark.) *Herald.*

Sand Carrier Turns Over in Cleveland Harbor

A MINOR replica of the historic Eastland steamship disaster—without loss of life—was enacted in Cleveland harbor recently, when the sand carrier *M. G. Hausler* overturned at the Pennsylvania dock north of



Shifting of its sand cargo caused the "M. G. Hausler to turn over

the old Union station. Its crew of 15 leaped safely to the dock when the boat started to list.

According to Captain H. A. White of the freighter *Earl F. Foster,* a witness, the *Hausler* listed because of a leak in one side. As it slanted to a noticeable angle, its sand cargo shifted and the boat flopped over. It reposed in the harbor looking like a huge turtle come up to the surface to gaze at the city's skyline.

The *Hausler* had arrived earlier in the day from the vicinity of Vermilion. It is owned by the Cameron Steamship Co., Detroit.

The *Eastland,* an excursion steamer, turned over in the Chicago river about 12 years ago and hundreds of passengers were drowned.—*Cleveland* (Ohio) *News.*

Expansion of Pennsylvania Lime Plant

H. E. MILLARD, Annville, Penn., recently purchased the Walter T. Bradley lime plant, Swatara, Penn., and has contracted with Lime and Hydrate Plants, Inc., York, Penn., for an addition of four Kuntz, gas-producer fired kilns. This will give the plant eight kilns. The original four-kiln plant was described in the annual review issue of ROCK PRODUCTS, December 22, 1928, as one of the outstanding developments in the lime industry in 1928.

Phoenix Company To Build New Gravel Plant

THE PHOENIX Sand and Gravel Co., which is now operating a gravel plant at Bagnell, Mo., having a 24-car per day capacity, now has plans under way for a new plant west of the Little Gravois creek.

The company recently bought from Dr. C. O. Brockman the island in the Osage river at the mouth of the creek which will be developed for its gravel resources.

It is stated that the company has a contract to supply the Union Electric with 1,600,000 cu. yd. of gravel, one of the largest gravel contracts ever awarded in this country to one firm. To fill this contract will require the installation of new and larger equipment. Two 600-hp. electric units, driven by Fairbanks-Morse diesel engines, will be installed, and the new plant will handle 100 carloads of gravel per day.

On the hillside, just west of the creek, the timber has been cleared away to make room for a camp. Buildings will include official headquarters, a building 24x28; two bunk houses, each 20x44; office building, 16x24; mess hall, 20x40, and five cottages.

The new plant is built expressly for supplying gravel for the power project, while the plant east of the Gravois will be continued to supply gravel commercially. The new plant will employ from 50 to 100 men.

Jess Perkins is general superintendent of the company, Berl McInerney is president, and Bert Robinson is superintendent of construction.—*Jefferson City* (Mo.) *News.*

Medusa Portland Elects Officers

J. B. JOHN was elected president and general manager and other officers and directors were elected at a recent organization meeting of the Medusa Portland Cement Co., it was announced recently. This followed the consolidation of the Newaygo Portland Cement Co. of Michigan and the Manitowoc Portland Cement Co. of Wisconsin with the Medusa Portland Cement Co.

Directors of the combined companies include Alva Bradley, A. C. Dustin, E. B. Greene, E. S. Hanson, W. G. Mather, J. B. John, E. J. Maguire and W. B. Newberry, Cleveland; Charles C. West, former president of the Manitowoc Cement Co., Manitowoc, Wis.; L. E. Geer, vice-president and treasurer of the same company; Dan P. Eells, vice-president of the Bucyrus-Erie Co., South Milwaukee, Wis. Clay H. Hollister, president, Old Kent Bank of Grand Rapids, Mich., and L. E. Geer are principal owners of the Manitowoc Ship Building Co.

Officers in addition to President John include E. J. Maguire, vice-president and treasurer; Charles C. West, vice-president; W. B. Newberry, assistant general manager; P. G. Dawson, secretary; Frederic Pickford, assistant secretary; Henry Jeavons, assistant treasurer.—*Cleveland* (Ohio) *Plain Dealer.*

Manufacturers' Division, N. C. S. A., Meets in New York

THE ANNUAL PRECONVENTION DINNER MEETING of the Manufacturers' Division of the National Crushed Stone Association was held at the Pennsylvania Hotel, New York City, Friday, October 25. On account of the temporary indisposition of the chairman, E. G. Lewis, eastern manager of the Bucyrus-Erie Co., H. M. Davison, sales manager of the Harnischfeger Sales Corp., presided. Members of the executive committee of the National Crushed Stone Association and members of the New York State Crushed Stone Association were

Incidentally, this was the largest pre-convention meeting of the Manufacturers' Division ever held. As usual, the arrangements were made by Gordon Buchanan, president of the C. G. Buchanan Co.

Other than a general discussion of convention plans for 1930 (Cincinnati, Ohio, January 20-23), no business was transacted, "and a general good time was had by all." Addresses were made by W. F. Wise, president, National Crushed Stone Association; Otho M. Graves, past-president; E. J. Krause, past-president; John Rice, past-president; by H. S. Bair, F. T. Gucker and A. L. Worthen, members of the executive committee; and by A. T. Goldbeck, engineer, and J. R. Boyd, secretary, of the National Crushed Stone Association.

Registration

Allis-Chalmers Manufacturing Co., Milwaukee, Wis. G. W. Maisak, H. W. Erickson, W. C. MacEwen.

Atlas Powder Co., Wilmington, Del. A. D. Hammond.

Earle C. Bacon, Inc., New York City. S. F. Macpeak, W. H. Milroy, W. V. Pietsch.

C. G. Buchanan Co., Inc., New York City. Gordon Buchanan, G. W. Flounders, G. H. Keppel.

Bucyrus-Erie Co., Milwaukee, Wis. R. W. Conant.

Cross Engineering Co., Carbondale, Penn. W. S. Nicol.

Detachable Bit Corp. of America, New York City. W. C. Rea, R. W. Sanders.

E. I. du Pont de Nemours and Co., Wilmington, Del. T. M. Garrett, J. A. Lang, S. R. Russell, E. I. Wolf.

Easton Car and Const. Co., Easton, Penn. J. C. Farrell.

Frog, Switch and Manufacturing Co., Manganese Steel Forge Co., Philadelphia, Penn. E. L. Pemberton.

Gardner-Denver Co., Denver, Colo. C. E. Kaiser.

Gill Rock Drill Co., Lebanon, Penn. Fred A. Gill.

Harnischfeger Sales Corp., Milwaukee, Wis. H. W. Davison, Mr. Deephouse.

Hendrick Manufacturing Co., Carbondale, Penn. B. G. Dann.

Hercules Powder Co., Wilmington, Del. S. A. Johnson.

Ingersoll-Rand Co., New York City. A. A. Holland, E. H. Paull, J. M. Wells.

Kennedy-Van Saun Manufacturing and Engineering Co., New York City. C. A. Adams.

Keystone Lubricating Co., Philadelphia, Penn. Leo Englander, R. C. Smith.

Link-Belt Co., Chicago, Ill. Wm. A. Schnell.

Loomis Machine Co., Tiffin, Ohio. J. Reynard.

Mack-International Motor Truck Corp., Philadelphia, Penn. F. B. Barnitz, Earl B. Hill, W. B. Jupp, C. W. MacMillen, E. M. Post, Jr., H. L. Waehling, F. A. Warner.

Marion Steel Shovel Co., Marion, Ohio. R. S. Johnson, W. N. Westland.

McLanahan Stone Machine Co., Hollidaysburg, Penn. A. H. McLanahan, Ward McLanahan.

Niagara Concrete Mixer Co., Buffalo, N. Y. S. C. Hodge, F. J. Morrison.

Nordberg Manufacturing Co., Milwaukee, Wis. L. D. Hudson.

Pit and Quarry, Rand McNally Bldg., Chicago, Ill. L. M. Weiss.

Robins Conveying Belt Co., 15 Park Row, New York City. J. H. Robins, M. S. Lambert.

ROCK PRODUCTS, 542 South Dearborn St., Chicago, Ill. F. S. Peters, N. C. Rockwood, C. L. Walker.

Ross Screen and Feeder Co., New York City. E. Webster.

Sanderson-Cyclone Drill Co., Orrville, Ohio. W. F. Nothacker.

Traylor Engineering and Manufacturing Co., Allentown, Penn. D. A. Cheytte.

Westinghouse Electric and Manufacturing Co., New York City. B. L. Clegg, C. C. Bawden.

OFFICERS OF ASSOCIATION AND MEMBERS OF EXECUTIVE COMMITTEE WHO ATTENDED AS GUESTS OF MANUFACTURERS' DIVISION

W. F. Wise, president, Southwest Stone Co., Dallas, Tex.

F. T. Gucker, treasurer, John T. Dyer Quarry Co., Norristown, Penn.

J. R. Boyd, secretary, Merchandise Building, Washington, D. C.

A. T. Goldbeck, director, bureau of engineering, Merchandise Bldg., Washington, D. C.

H. E. Bair, the France Stone Co., Toledo, Ohio.

O. M. Graves, the General Crushed Stone Co., Easton, Penn.

E. J. Krause, Columbia Quarry Co., St. Louis, Mo.

A. L. Worthen, Connecticut Quarries Co., Inc., New Haven, Conn.

MEMBERS OF NEW YORK STATE CRUSHED STONE ASSOCIATION WHO ATTENDED AS GUESTS OF MANUFACTURERS' DIVISION

J. R. Callanan, Callanan Road Improvement Co., South Bethlehem, N. Y.

W. W. Duff, Lake Erie Limestone Co., Youngstown, Ohio.

A. J. Hooker, Buffalo Crushed Stone Co., Buffalo, N. Y.

F. S. Jones, General Crushed Stone Co., Easton, Penn.

G. J. Murphy, General Crushed Stone Co., Little Falls, N. Y.

A. S. Owens, Eastern Rock Products Co., Schenectady, N. Y.

F. C. Owens, General Crushed Stone Co., Auburn, N. Y.

C. L. Petzel, New York Trap Rock Corp., New York City.

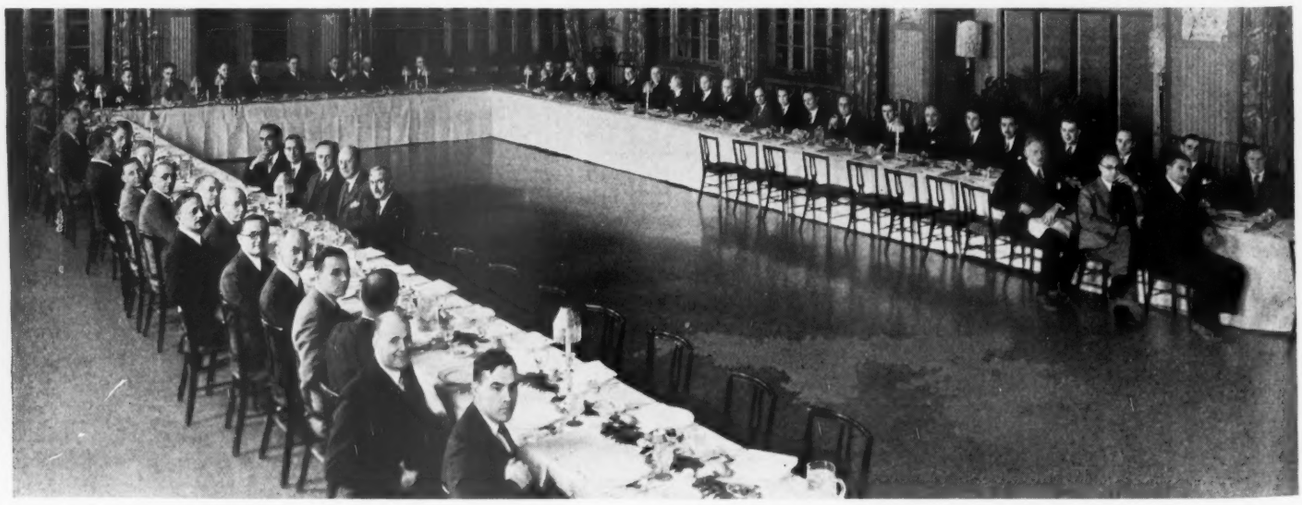
John Rice, General Crushed Stone Co., Easton, Penn.

John Rice, Jr., General Crushed Stone Co., Easton, Penn.

H. J. Russell, Jointa Lime Co., Glens Falls, N. Y.

A. G. Seitz, General Crushed Stone Co., Syracuse, N. Y.

G. E. Schaefer, General Crushed Stone Co., Rochester, N. Y.



The "set-up" but not all the diners who attended the annual meeting of the Manufacturers' Division of the National Crushed Stone Association at New York, October 25

Sand-Lime Brick Production and Shipments in October

THE following data are compiled from reports received direct from 15 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is three less than those furnishing statistics for the September estimate published in the October 12 issue. The statistics below may be regarded as representative of the entire industry, the reporting plants having about one-half the production capacity in the United States and Canada.

It is estimated that production of sand-lime brick, rail and truck shipments and unfilled orders for October remain about the same as in September, although there is considerable difference between the figures for the two months, due to the fact that 18 plants reported for September, as compared with 15 for October. Estimates show, however, that stocks on hand increased somewhat in October.

The following are average prices quoted for sand-lime brick in October:

Average Prices for October

Shipping Point	Plant Price	Delivered
Columbus, Ohio	$13.00	$14.50
Dayton, Ohio	12.50	15.50
Detroit, Mich.	13.00	15.50@16.00
Detroit, Mich.	.....	15.50@16.00
Detroit, Mich.	13.25	16.00
Hartford, Conn.	14.00	19.00
Madison, Wis.	12.00@12.50	13.00@14.00
Milwaukee, Wis.	10.50	13.00
Mishawaka, Ind.	11.00	.....
Pontiac, Mich.	12.50	15.50
Saginaw, Mich.	12.00	.....
Syracuse, N. Y.	18.00	20.00
Winchester, Mass.	.....	16.00

The following statistics are compiled from data received from 15 producers in the United States and Canada:

Statistics for September and October

	*September	†October
Production	14,121,000	11,024,000
Shipments (rail)	3,960,000	2,602,000
Shipments (truck)	10,951,000	7,055,000
Stocks	9,326,000	7,857,000
Unfilled orders	13,286,000	7,020,000

*Revised to include one plant not included in statistics published for this month. Eighteen plants reporting; incomplete, one plant not reporting production and stocks on hand, and five not reporting unfilled orders.

†Fifteen plants reporting; incomplete, six plants not reporting unfilled orders.

Notes From Producers

Sand Lime Products Co., Detroit, Mich., has enlarged its plant and installed two new Jackson and Church presses, a new steaming kettle with quick closing head, and other new equipment. The company reports that it has supplied "Rock-O-Lite" sand lime brick for the new plant of the Detroit Steel Products Co., new Roosevelt high school and the Wilbur Wright school, all of Detroit, as well as the Mueller Brass Co.'s factory in Port Huron, Mich., and the Inkster high school in Inkster, Mich.

Paragon Plaster Co., Syracuse, N. Y., has supplied sand-lime brick for the National Casket Co.'s plant.

Walker and Frank Brick Co., Detroit, Mich., advise that they are furnishing the sand-lime brick for a six-story apartment building which will be solid sand-lime brick, except for face brick veneer on front. They are also furnishing brick for the Mitchell and Smith factory, which will be lined with sand-lime brick on the inside.

White sand-lime brick, supplied by Boice Bros., Pontiac, Mich., is being used for the Pontiac City hospital.

The Columbus Builders Supply Co., Columbus, Ohio, is furnishing sand-lime brick for the following: New buildings of the Exact Weight Scale Co. and Central Ohio Paper Co., Lutheran Book Concern addition and the plant of the Miller Machine Mold Co.

Code of Ethics Adopted by the Feldspar Grinders' Institute, Inc.

(To promote harmonious action in all matters pertaining to the best interests and welfare of feldspar grinders)

1. Indirect or underhand selling or buying methods intended to influence anyone improperly is prohibited.

Richard Wainford, president, Feldspar Grinders Institute, Inc.

2. The making or circulating of false or misleading statements, either written or oral, respecting a competitor's product, service, or selling price or regarding his business, financial or personal standing is prohibited.

3. No over-statement or misrepresentation shall be made.

4. No order larger than can reasonably be delivered within the terms of the agreement shall be accepted.

5. Discrimination in prices between different purchasers or different localities based upon other than legitimate differences in costs is prohibited.

6. No attempt shall be made to persuade a customer to break a contract with a competitor.

7. No offer of employment to a competitor's employes shall be made unless, without solicitation, they ask for employment.

8. Material shall not be sold at or below cost for the purpose of annoying, harassing, or eliminating a competitor, or otherwise.

9. The permanent rendering of any unusual service or giving of terms greatly exceeding the usual trade practice is prohibited.

10. The buying of business by the payment of a commission or bonus to persons not in the seller's employ is prohibited.

11. Only such samples of products as are made from stock materials shall be submitted for the consideration of prospective customers.

12. No competitors' samples shall be used for the purpose of disparaging the quality of his product.

13. No special discounts nor rebates shall be allowed which are not reported as part of the price, and the purchaser shall be charged for the actual grade and grinding of the material shipped.

14. Dealers, salesmen and agents shall be provided with this code and as far as possible they shall be induced to conform with it.

Valve Slogan Contest

CONTESTANTS for the $500 in cash prizes offered by the Merco Nordstrom Valve Co. for appropriate slogans that express the advantages of the Nordstrom valve must submit their slogans on or before December 31, 1929, as the contest closes on that date. According to the rules of the contest, no one is barred from submitting slogans except employes of the company. Any number of slogans may be sent in by a contestant—but none can be more than 10 words in length to receive consideration.

The winner of first prize will receive $250; $100 is to be awarded for second prize and $50 for the third prize. There are also four prizes of $10 each and twelve prizes of $5 each—making a total of $500 in nineteen cash prizes to be distributed in the contest.

Entries should be made to the company at 343 Sansome street, San Francisco.

Foreign Abstracts and Patent Review

Influence of Coarse Aggregates Upon the Quality of Concrete. Kurt Pfletschinger reviews briefly some of the results of the studies of Abrams, Graf, Gilkey, Talbot, Bolomey, Probst, Brandt, Fuller, Edwards, Young, Hummel, Maier, Merkle, Bethke, Kortland, and Eisfelder, insofar as they bear relation to the problem of the influences of aggregates upon the quality of concrete. Pfletschinger's researches towards the solution of this problem deal chiefly with the effects produced by coarse aggregates, a field of research which has been more or less neglected.

With a few exceptions he employed for his mortar specimens a mixing relation by weight of 1:8, that is, on the average about 250 kg. cement per 1 cu. m. (approximately 4.7 bags of cement per cu. yd.) of finished concrete. The sand aggregate used throughout consisted of river sand of the following sieve analysis: 20%, 0-0.3 mm. (0 to 90-mesh); 20%, 0.3-0.8 mm. (90-mesh to 30-mesh); 30%, 0-0.3 mm. (30-mesh to 9-mesh); 30%, 3-5 mm. (9-mesh to 5-mesh). When gravel was employed as coarse aggregate, the sand used in the concrete amounted to 40% of the total aggregate by weight, and when crushed stone was used, to 48%, more sand or mortar being required for the crushed stone aggregate because of its greater volume in voids, as compared to gravel aggregate. The sand ranged from 90-mesh to $\frac{3}{16}$-in. (American sieves) as above; and the coarse aggregate (gravel, crushed stone) from $\frac{3}{16}$-in. to $2\frac{3}{4}$-in.

The following conditions of the aggregate are of importance to the quality of the concrete prepared with it: granular size, and granular combination; shape; surface structure such as porosity and ability to absorb water; percentage of each aggregate in the total aggregate; specific strength; specific gravity; stability against chemical action; and elasticity. The four last named conditions were not investigated. In one group of tests the same water-cement factor by weight was employed; and in another group the same consistency as customary in practice, being plastic and pourable.

The grading combination by weight of the mortar specimens was quite varied, there being nine different combinations containing gravel of different gradations and 40% river sand; and nine combinations containing crushed stone of different gradations and 48% river sand. All told, 789 test specimens were prepared for the main tests, of which 498 were cubes and 222 beams. Fig. 1 shows the grading curves of the nine test series using mixtures with 40% sand. The curves for the concrete mixtures with 48% sand run the same, proportionately.

* * *

The group of tests in which specimens of the same water-cement ratio were used, showed that within the limits of the law of the water-cement ratio, one cannot recognize a distinct, uniform influence of the size and gradation of the coarse aggregates. Still, there is a tendency for the compressive strength to increase in concrete mixtures having coarser aggregates. The mortar prepared each time with the same water-cement ratio for various concrete mixtures and of the same composition as used in concrete, showed always smaller strengths than the corresponding concrete. In the case of crushed stone concrete, the differences were 15% to 43%.

The group of tests in which specimens of the same consistency were used as employed in concreting work, indicated a perceptible influence of the size of the coarse aggregates. The water requirement decreases as the portion of the large aggregate increases, and the compressive strength increases correspondingly. In this group of tests an essential influence of the gradations could not be detected.

The strengths of all specimens made from corresponding mortars, are for gravel concrete 16 to 28%, and for crushed stone concrete, 20 to 37% below the strength of concrete with the same composition of sand.

Two series of tests made to determine the influence of the quantity of coarse aggregates contained in the concrete, showed that for a minimum sand content of about 30% in gravel concrete and 40% in crushed stone concrete, the strengths of the concrete are within plus or minus 20% of the strengths of the mortar contained in it. The portion of sand in the plastic mixes was gradually decreased from 100%. It should be considered that thereby the cement content decreases 35% to 40%. The economical importance of the coarse aggregates consists therefore in the portional substitution of the expensive mortar without loss of strength and workability. The results indicate the necessity of decreasing the sand content of concrete mixtures as much as possible, for thereby the water requirement is decreased considerably and the strength is increased while the cement content is continually constant.

Two series of tests made with gravel, crushed porphyry, sandstone and crushed brick as coarse aggregate, showed that the water requirement for obtaining a certain consistency for the various kinds of aggregates are quite different due to the size, condition and porosity of the surface of the coarse aggregate as well as due to the influence of the adhering rock dust. The shape of the coarse aggregates does not perceptibly affect the compressive strength.

When the greater quantity of sand (in this case 8%) required in crushed stone concrete mixtures is considered, the crushed stone concrete is from 20% to 50% inferior to the gravel concrete in comparing their compressive strengths.

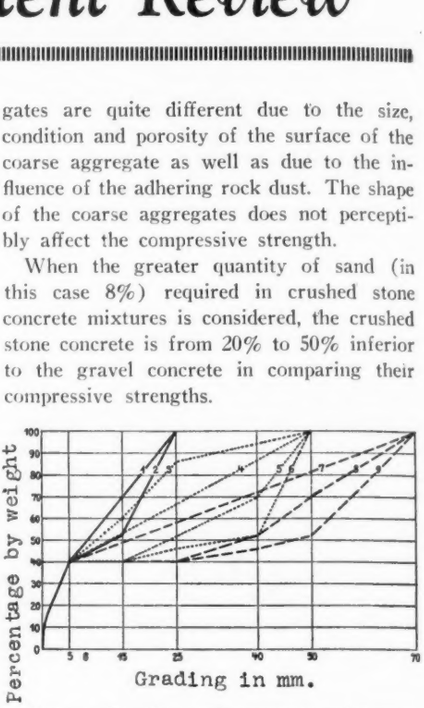


Fig. 1. Gradings of concrete mixtures with various sizes of aggregates and 40% sand

For obtaining a high flexural tensile strength, a good gradation is essential. The quantity, shape and surface condition of the coarse aggregate act similarly as for compressive strength. The crushed stone aggregate is found to be better due to its rough and therefore larger surface which assures intimate contact with mortar.

* * *

The size and gradation of the coarse aggregate showed no perceptible influence upon the elasticity of the concrete; gravel concrete was found to have smaller variations in shape than crushed stone concrete; that is, it showed a higher elasticity modulus.

* * *

In the tests for variation of the volume of concrete, the size of the coarse aggregates was determined to be without useful influence upon shrinkage. The shrinkage was considerably greater in crushed stone concrete than in gravel concrete.

* * *

No perceptible influence of the size and gradation of the coarse aggregates upon the permeability of the concrete to water could be determined. Crushed stone concrete with a higher requirement in water is inferior to gravel concrete at the same consistency. Therefore, an aggregate should be used which requires a minimum of sand to fill voids and a minimum of water for obtaining a workable consistency. Gravel shows this property to a greater extent than crushed

stone. The size and gradation of the course aggregates is of no essential importance.

* * *

In testing the influence of the coarse aggregates in the concrete structure, it was shown that in all mixes all coarse aggregates were covered well with mortar on all sides. As the size of the aggregate increases, the mortar suffices better to fill the voids between the coarse aggregates. In using the coarser gradations of aggregates, the veins of mortar running in the concrete are much stronger than when finer mixtures are used. Less water can thus be used by using coarser aggregates, the concrete structure becoming poorer in no instance. In the beam breaking test in the rods of crushed stone concrete, the break passes more frequently through the aggregate than in the beam of gravel concrete. The use of the possibly largest coarse aggregates permits one to limit to a minimum the sand or mortar content as the weaker part of the concrete, without loss in a closed uniform structure.

* * *

For the same sand content, the concrete is easier to work as the coarse aggregates increase in size; this condition is still further improved for the same sand content by increasing the portion of the coarsest granules of the entire content of coarse aggregates.

* * *

Upon the basis of the results obtained and from the viewpoint of economy, the following sand contents by weight are recommended for aggregates of different sizes:

For gravel concrete: about 45% sand for gravel to 1-in. size; about 40% sand for gravel to 2-in. size; and about 37% sand for gravel to 2¾-in. size.

For crushed stone concrete: about 52% sand for crushed stone to 1-in. size; about 47% sand for crushed stone to 2-in. size; and about 44% sand for crushed stone to 2¾-in. size.

The sand should be well graded; the portion of fine sand (to 90-mesh size) being about 6% to 10% of the entire aggregate. Favorably selected coarse aggregates increase economies in concrete construction by saving expensive mortar; they improve the workability, increase the solidity, the compressive strength and the flexural-tensile strength.—*Zement* (1929) **18,** 31, pp. 955-980; 32, pp. 977-980; 33, pp. 1005-1008; 34, pp. 1035-1040.

Technical Data Concerning the Daignac (France) Cement Plant. A. Steiger describes in detail the various technical aspects of cement production at this mill. The raw cement mixtures are calculated by the Gruen graphic method to obtain a cement high in tricalcium silicate. The rotary kiln (10 ft. in dia. by 197 ft.) has a capacity of 900 to 1100 bbl. per day and is operated on the wet process. About 10% excess air is supplied the kiln; 75% of the combustion air is preheated to 687 deg. F. in the cooler, and the air-pulverized coal mixture enters the kiln at a temperature of 626 deg. F. The clinker leaves the kiln at about 2102 deg. F. and the cooler at 212 to 302 deg. F.; thus 80,000 B.t.u. are recovered per 220 lb. of clinker. The slurry contains from 35 to 40% water.

The author gives a detailed study of chimney height and draft, volume of flue discharge, analysis of coal, entrance of supplementary air, etc., also heat calculations, with various tables, necessary for burning cement in the rotary kiln, dealing with evaporation of water from the slurry decarbonation, heating to clinkering temperature, loss of heat in radiation, loss in discharging gases, heat recovered from the clinker, etc. He also shows that the three-compartment tube mill, when operated at less than full capacity, loses in efficiency, and gives diagrammatic data to support the findings and which are used as a guide in operation

Slurry mixing tanks are equipped with compound air agitators, which effect an efficient mixing of the slurry at periodic and consecutive intervals for each tank.—*Rev. de Mat. de Constr.* (1929) 232, 233.

Chemical Composition of Bauxites. According to Elber, bauxite is essentially an oxide of hydrated alumina of the formula:

$$(Al_2O_3 \cdot 2H_2O) \text{ or } \begin{matrix} & /OH \\ Al- & OH \\ & > O \\ Al- & OH \\ & \backslash OH \end{matrix}$$

In general the bauxites contain 3 to 4% silica, 25% ferric oxide, and 3 or 4% titanium oxide; the French bauxites contain generally 12% H_2O and the American bauxites about 30%. The French bauxites, with about 75% Al_2O_3, are considered superior. Analysis methods and determinations of Fe_2O_3, TiO_2, Al_2O_3, CaO are given from the viewpoint of the use of bauxite for fire brick in cement kilns.—*Rev. des Mater. de Constr. et de Trav. Pub.* (1929) 234.

Influence of the Fineness of Portland Cement Upon Its Properties. P. Filossofow of Moscow, in a report on the significance of the degree of fineness of grinding of portland cement, states that Schubenkin employed a portland cement of the following chemical composition: SiO_2, 20.80%; Al_2O_3 plus Fe_2O_3, 9.89%; CaO, 64.40%; MgO, 0.96%; loss on ignition, 1.64%; alkalies, 2.76%. About 25% of makeup water was used for the mortar of neat cement, and 8.5% for the 1:3 mortar. The degree of fineness of the cement was as follows:

Residue on 900 mesh (76 mesh) screen....	2.0%
Residue on 4900 mesh (178 mesh) screen....	11.0%
Throughs on 4900 mesh (178 mesh) screen..	87.0%
Total	100.0%

The cement complied with the test for consistency in volume, and its mechanical strengths were as follows in lb./in.²:

	7-day	28-day
Tensile strength of neat cement mortar	597	977
Tensile strength of 1:3 mortar	318	412
Compressive strength of 1:3 mortar		3320

The cement was separated into two fractions, namely a residue *G* and a through *F* of the 254-mesh sieve. The following mixtures were prepared from the coarse fraction *G* and the fine fraction *F;* No. 1—100% F, 0% G; No. 2—90% F, 10% G; No. 3—70% F, 30% G; No. 4—50% F, 50% G; No. 5—30% F, 70% G; No. 6—10% F, 90% G; No. 7—0% F, 100% G. A fraction No. 8 of large cement granules was prepared from the residue on the 178-mesh sieve.

The setting period of the cement specimens in hours and minutes was as follows: No. 1, 9:30; No. 2, 9:45; No. 3, 10:30; No. 4, 11:50; No. 5, 12:00; No. 6, 14.15; No. 7, 19:00; No. 8, 26:00. The tensile strength of the neat cement specimen in kg. per sq. cm. was as follows:

	—Time of Storage in Water—			
	7 days	28 days	90 days	180 days
Mix No. 1	61.1	65.0	60.2	56.0
Mix No. 2	54.0	63.5	56.1	57.2
Mix No. 3	43.2	69.2	70.0	70.2
Mix No. 4	41.2	61.3	60.0	61.1
Mix No. 5	36.3	55.3	57.1	58.2
Mix No. 6	25.0	49.0	51.3	56.0
Mix No. 7	23.0	45.1	46.6	53.0
Mix No. 8	3.5	30.4	35.7	53.1

Specimen cubes made with three parts sand from the cement fractions, 1, 3, 5, 7, showed after 28 days' storage in water compressive strengths of the mortar in kg. per sq. cm. as follows: 425.6, 225.33, 202.3, 125.1, respectively.

According to the test results, the very finest grinding does not result in the most favorable tensile strengths. The most favorable granular combination of cement in reference to the pure cement, is maintained when 70% pass through the 254-mesh sieve. The strength of the 1:3 mortar increases in full accordance with an increase in the fineness of cement.—*Tonindustrie-Zeitung* 1929) **53,** 72, pp. 1302-1304.

Reactions Between Colloidal Silica and Lime. P. Jolibois and L. Chassevent state that the silicates of lime obtained by burning at high temperatures are attacked by water. Some lime and some silicate enter into solution and these two react with each other to form hydrated products. H.Le-Chatelier and Lafuma have shown that they form, either by the addition of an excess of lime water to a solution of colloidal silica or by the course of setting of silica cements, a hydrated monocalcium silicate which disintegrates in water until the concentration of the solution becomes 0.52 g. of lime per liter.

The authors studied the progress of the reaction in solutions containing silica and lime of different concentrations. The solutions of silica and of lime were mixed and agitated at 86 deg. F. When the solution was sufficiently concentrated with silica and lime a gelatinous precipitation formed at once, as already observed by Michaelis. For example, after 3 minutes there was 0.0239 gram molecules of silica precipitated per liter of solution containing equal volumes of solutions of silica and of lime of initial con-

centrations of 0.0263 SiO_2 and 0.0112 CaO gram molescules per liter respectively.

The variation of lime content in the precipitate of the solutions was determined by reading the resistance of an electrical circuit passed through the solution over a period of 50 days at constant temperature of the solutions and over the consecutive period of 50 days to six months at fluctuating temperatures; the initial concentration of the silica solution being kept constant and that of the lime solution being varied. There was found to be a relation in the quantity of silica and of lime contained in the precipitate at the moment of its formation, which varies between 10 and 1, according to the concentrations in silica and in lime of the solution. It cannot be held that the precipitate which is rapidly formed by the reaction between the colloidal silica and the lime is a definite compound. Further, the precipitation of the silica is a phenomena of coagulation due to the action of the lime. The silica fixes lime in the course of its coagulation, but the quantity of lime fixed increases for a long time even when all the silica has been coagulated rapidly.

The data compiled in the test tables show that the concentration in lime of the solution does not vary appreciably after some days for mixtures containing less than a molecule of lime per molecule of silica. The condition corresponding to a concentration of 0.63 g. of lime per liter at 86 deg. F. places in evidence the formation of a definite compound: viz., the hydrated monocalcium silicate. The precipitate which was obtained with the mixtures highest in lime continued for months to fix lime by adsorption. These precipitates, analyzed after six months, contained from 1.47 to 1.62 gram molecules of lime per gram molecule of silica. The silicate of hydrated lime furnishes through hydrolysis of the solutions sufficient concentrations in lime for coagulating silica.

The authors conclude that the reactions between silica and lime in solution are due to: 1—coagulation of the silica by the lime; 2—fixation of the lime by the silica, giving a silicate of hydrated lime; 3—adsorption of the lime, this adsorption continuing for months in solutions which are high in lime. —*Ciment* (1929), **7**, pp. 318-319.

Efficient Burning of Lime. O. Wolcen stresses the need of greater heat efficiency, savings in power and the reduction of labor to the minimum in the operation of lime-burning plants. He considers briefly, fuel consumption, manual labor, etc., the advantages and disadvantages, economically, of the rotary kiln, the ring or chamber kiln, the tunnel kiln and the shaft or vertical kiln with mixed feed, or external firing with coal, coke, powdered coal, oil or gas. The introduction of gas firing for the shaft kiln brought also some disadvantages including higher installation costs due primarily to necessarily reduced capacity and increased manual labor, so that a number of improved designs of gas-fired kilns have been developed recently.

In the gas-fired kiln, forced draft is used to effect a more uniform distribution of the flame; this requires an air-tight base for proper combustion and effecting discharge through the base. However, German patent No. 357,420 (H. Koppers, Essen), used a drawing zone in a sealed room. As shown in Fig. 1 *a* is the kiln shell, *d* the gas line, *e* the gas nozzles, *f* the draw hoppers for

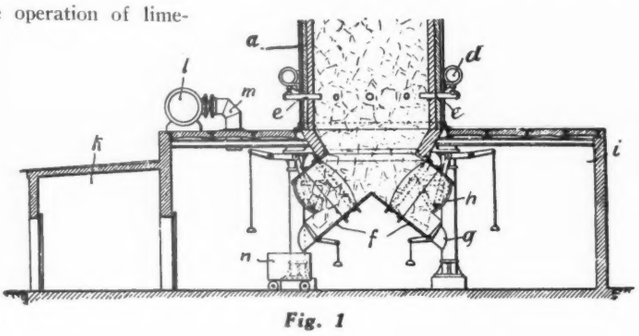


Fig. 1

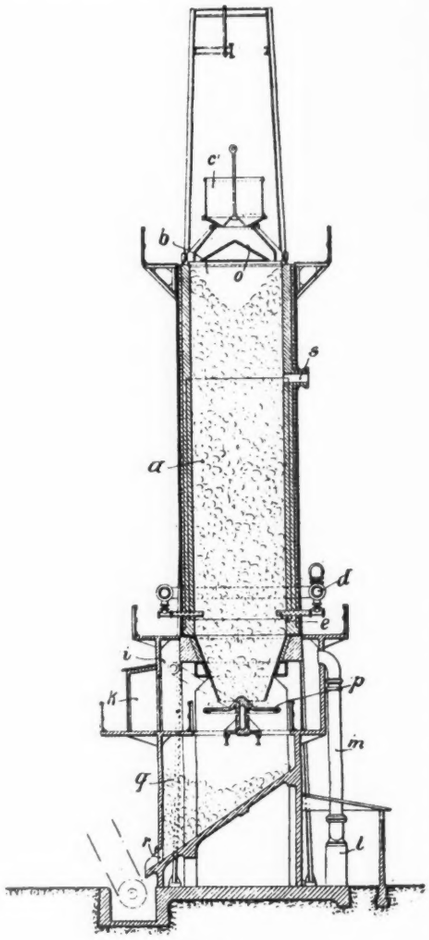


Fig. 2

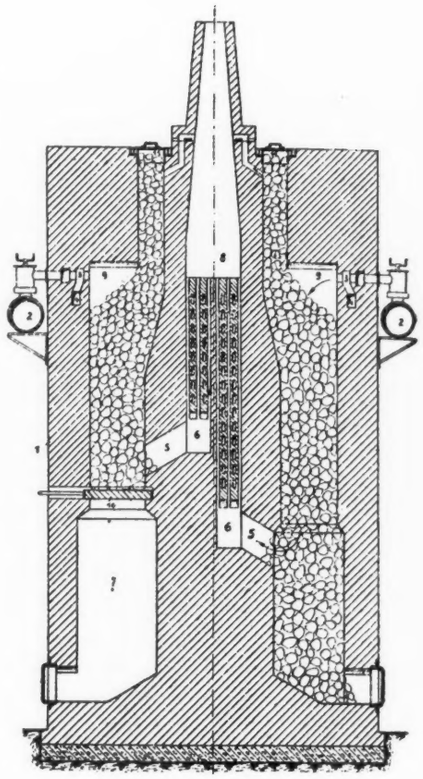


Fig. 3

the lime, *g* and *h* the gates, *i* the chamber enclosing the entire kiln and the operators, *l* the blower supplying combustion air through duct *m*, *k* the hatch to the sealed chamber *i*. This simple construction was altered to provide automatic continual lime drawing according to German Patent No. 358,295, and as shown in Fig. 2. The rotating plate *p* at the base of the kiln discharges the burned lime continually into the sealed chamber *i*, which is equipped with a hopper *q* from which the lime is removed through the gate *r*. Combustion air is supplied through ducts *l* and *m*, and the flue *s* permits withdrawal of combustion gases as a check against possible over-preheating, raising the temperature of waste gases, etc.

According to German Patent No. 358,587 (Allgemeine Vergasungs Gesellschaft, Berlin-Halensee), a more uniform heating throughout the kiln without excess waste of heat in kilns of larger cross-section area is effected by providing the gas nozzles, which are fed at high pressure through a gas line, in such a way that they touch tangentially an imaginary circular zone located within the shaft. A kiln of doubtful value and operating on the direct-current principle, instead of the counter-current principle as illustrated above, in which air and flame move in opposite directions, is described in German Patent No. 459,950 (L. Riedlhammer, Nuernberg), and shown in Fig. 3. The left side is for periodic and the right side for continuous operating. Gas is fed through the line *2* to the burners *3* and hot combustion

air at the same time through the ducts *4*, the flame forming in the chamber *9* and passing with the hot combustion products and fuel downward to the discharge *10*. The hot flue gases are passed through ducts *5* to the recuperators for heating the combustion air and pass off through the flue *8* unless drawn through the filling shaft to preheat the limestone.

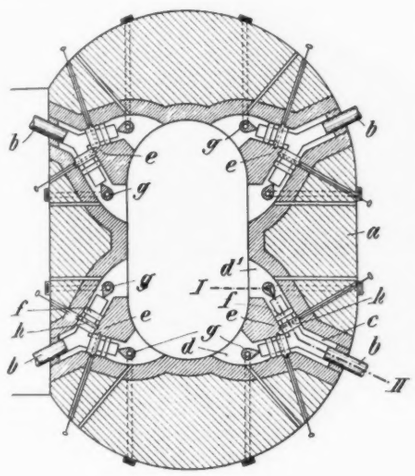


Fig. 4

German Patent No. 375,528 (Fr. Mueller, Elbingerode), covers the suitable provision of a special combustion chamber in the lining of a pulverized-coal-fired shaft kiln, in which the coal can burn with very low excess air. As shown in Fig. 4, *a* is the brick lining, *b* the pulverized-coal supply nozzles, *c* the combustion chambers, *d* and *dl* the ducts through which the flames enter the kiln. Air-cooled chamotte wedges *g* are provided in the ducts to divide the burning flames once more; *h* are the regulators in the individual firing ducts. According to German Patent No. 458,374 (A. B. Helbig, Berlin), by special arrangement a gas producer is provided to burn the pulverized coal first to give a combustion gas rich in carbonic monoxide before it reaches the preheated limestone in order to guard, by the resulting chemical actions, against excessive lime burning temperatures.—*Tonindustrie-Zeitung* (1928) **52**, 83, pp. 1652-55.

Operation and Efficiency of Air Separators. P. Rosin and E. Rammler discuss air separators and the principles of air separation as applied to the preparation of pulverized coal.—*Zement* (1929), **18**, 26, 31, 32.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

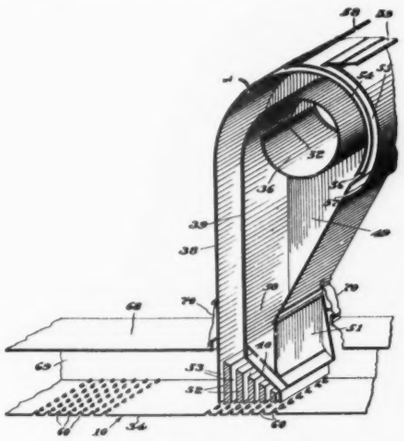
Plastic Paint. Plastic paint composed of 70 parts by weight of the following mixture: Lithopone, 65; powdered mica, 7; silica, 7; portland cement, 3; plaster of paris, 18, (all ingredients by weight), combined with 30 parts by weight of the following mixture: Linseed oil, 41; mineral spirit, 55; dryer, 3; water, 1, (all ingredients by weight).—*A. Mills, U. S. Patent No.* 1,720,135.

Effects of Cement Dusts on Worker's Health. The physical analysis of numerous air samples taken at various places in a portland cement plant showed that the number of particles under 10μ ranged from 337,000 to 105,630,000 per cu. ft. and the number of particles over 10μ from 8500 to 1,069,000. The total solids amounted to 0.025-5.675 mg. per cu. ft. The chemical analysis of the dust gave the following results: 15.00-21.30% SiO_2; 4.20-9.10% $Me_2O_3 + Al_2O_3$; 36.11-60.88% Ca; 2.06-2.97% MgO; 1.75-4.08% SO_3; loss on ignition 4.75-40.40%. The uncombined silica was about 6.5% before the cement was burned in the kiln; afterwards the free silica in the dust of the respective rooms was reduced to 1%. The exposure to the Ca dusts seemed to predispose the workers to certain diseases as acute bronchitis, diseases of the nasal fossæ, pharynx and tonsils, skin, eyes and ears, digestive system and influenza and grip.—*Jour. Ind. Hygeine* (1929), **11**, 182.

Air Separation. The inventor calls attention to the fact that in air separators of the ordinary type the coarse particles separated carry a lot of fines with them. He therefore returns the coarse particles to a feeding mechanism and reclassifies them repeatedly.

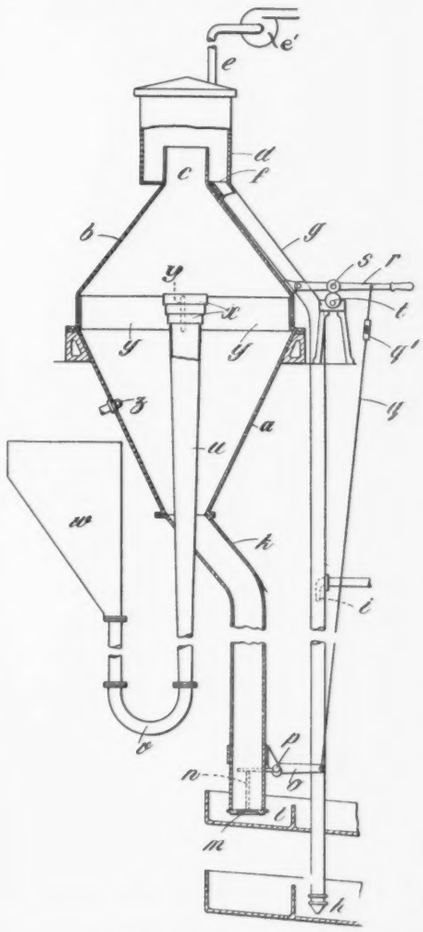
The feeder is a shaking table, or trough, with perforations arranged so that air is blown through them or drawn through them by suction. This blows the feed up into the classifying device, which is a horizontal spiral plate in a casing. The inside of the spiral is connected to a suction fan which draws off the fines while the coarse particles fall into a hopper through which they are discharged to the shaking table feeder trough a swinging gate.

Only one of the classifying spirals is shown in the illustration, but in the actual machine there are as many of these in series as are needed to free the coarse oversize from the fines.—*A. H. Stebbins,* U. S. No. 1,720,861.



Air separator with repeating reclassifier

Vacuum Flotation. A new apparatus for using the well-known Elmore vacuum process of flotation has been recently patented. The mixture to be treated, with the addition of a suitable frothing agent, enters through a central tube of conical shape. The enlarging of the diameter, due to this conical shape, keeps down turbulence in the ascending column of materials, which otherwise comes from the swelling of the froth. After passing out of this tube into the vacuum chamber the froth (which in this device is caused wholly by the action of the vacuum) goes to the top to be discharged through a down pipe. A jet in this pipe destroys the froth and helps the mineral to escape through a water-sealed valve at the bottom of the pipe. The worthless rock, which the froth does not lift, is rotated in the vacuum chamber by a tangential stream and this frees any fine particles of mineral which may have accompanied the rock and causes them to rise to the top where they are removed by the froth. The waste is discharged through a valve that is periodically opened by a cam and levers.—*F. E. Elmore.* March 19, 1929. U. S. Patent No. 1,706,281.



Vacuum flotation separating apparatus

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

	Limestone Flux Week ended		Sand, Stone and Gravel Week ended	
District	Oct. 5	Oct. 12	Oct. 5	Oct. 12
Eastern	3,421	3,676	16,648	17,075
Allegheny	3,421	4,061	9,720	11,018
Pocahontas	399	462	1,312	1,297
Southern	997	1,076	9,396	9,800
Northwestern	1,626	1,493	9,133	8,913
Central Western	637	564	14,258	12,311
Southwestern	652	607	9,379	8,743
Total	11,153	11,939	69,846	69,157

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1928 AND 1929

	Limestone Flux		Sand, Stone and Gravel	
	1928	1929	1928	1929
	Period to date		Period to date	
District	Oct. 13	Oct. 12	Oct. 13	Oct. 12
Eastern	122,632	138,305	457,866	464,161
Allegheny	140,505	147,600	305,995	297,974
Pocahontas	19,244	15,540	33,629	40,243
Southern	24,080	23,557	434,417	364,139
Northwestern	54,890	46,879	276,156	261,750
Central Western	18,194	21,363	423,440	433,913
Southwestern	17,036	20,357	255,791	279,507
Total	396,581	413,601	2,187,294	2,141,687

COMPARATIVE TOTAL LOADINGS, 1928 AND 1929

	1928	1929
Limestone flux	*396,581*	*413,601*
Sand, stone, gravel	*2,187,294*	*2,141,687*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning November 2:

SOUTHERN FREIGHT ASSOCIATION DOCKET

47626. **Crushed limestone,** from Riverton, Va., to Washington, D. C. It is proposed to establish rate of 90c per net ton on crushed limestone, carloads (See Note 3), from Riverton, Va. (applicable only from Southern Ry. tracks), to Washington, D. C. (Penn. R. R. delivery).

47654. Charge on **sand, gravel, crushed stone,** etc., reconsigned from Fort Bennings, Ga., to cover back haul service from and to Fort Benning Junction, Ga. It is proposed to amend C. of Ga. Ry., G. F. O. Special 8-AA, I. C. C. 2638, to provide for charge of 40c per net ton on sand, gravel, crushed stone, slag, rubble stone, broken stone and chert, in straight or mixed carloads (See Note 3), to apply on shipments reconsigned from Fort Benning, Ga., to cover back-haul service from and to Fort Benning Junction, Ga.

47693. **Sand, silica,** from St. Louis, Mo., to Sheffield, Ala. Eighth class rate of 810c per net ton now applies. Proposed rate on sand, silica, in packages or bulk, carload (See Note 2), but not less than 60,000 lb., from St. Louis, Mo., to Sheffield, Ala., 230c per net ton.

47819. **Sand, gravel, slag, etc.,** from Anniston and Montgomery, Ala., to W. & T. R. R. stations. Present rate, 160c per net ton. It is proposed to revise the present rate of 160c per ton on sand, gravel, slag, stone and chert, carloads, as described in Agent Glenn's I. C. C. A655, from Anniston, Ala., and Montgomery, Ala., to Meadows, Lovett and Manning, Ga., to basis of the mileage scale provided in Agent Glenn's I. C. C. A655, which will produce a rate of 170c per net ton; the present rate is published on basis of incorrect mileages.

SOUTHWESTERN FREIGHT BUREAU DOCKET

18647. **Sand,** from Lipe, Tenn., to Turrell, Ark. To establish a rate of $1.51 per ton of 2000 lb. on sand (except asbestos sand and silica sand), carloads (See Note 3), from Lipe, Tenn., to Turrell, Ark. Shipper states that the present rate of $2.10 per ton of 2000 lb. on basis of Memphis combination is prohibitive.

18649. **Silica rock,** from St. Clair, Mo., to points in Oklahoma. To establish the following rates on silica rock, carloads (See Note 2), from St. Clair, Mo., to points in Oklahoma. To Ada, Oklahoma City and Southard, Okla., 16c per 100 lb.; to Avant, Blackwell, Bristow, Checotah, Dewar, Eufaula, Henryetta, Muskogee, Okmulgee, Pawhuska, Sand Springs, Sapulpa, Shopton, Tulsa and Tulsa Exposition Grounds, Okla., 13½c per 100 lb.; to Lawton, Okla., 23c per 100 lb., and Ponca City, Okla., 14½c per 100 lb.; to O. U. Ry. stations, Fuller to Mounds, Okla., and to St. L.-S. F. Ry. stations, Red Fork to Sapulpa, Okla., Nola to Seaman, Okla., and Schulter to Blackstone Mine, Okla., 13½c per 100 lb. The proposed rates and minimum weight are the same as now applicable on silica sand from Pacific, Mo., in Item 7182 of S. W. L. Tariff No. 15N. Shipper desires same rates on silica rock from St. Clair, Mo., a point intermediate to Pacific, Mo.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

18708. **Silica,** from Rogers, Ark., to New Orleans, La. To establish a rate of 33½c per 100 lb. on silica, crushed or ground, in bulk, in bags; and silica flour, in bulk, in bags, carloads, minimum weight 60,000 lb., from Rogers, Ark., to New Orleans, La. Shipper at Rogers, Ark., competes with shipper at Tamms, and requests the publication of the same rate.

18729. **Gravel, etc.,** between points in the southwest and points on the Texas Electric Ry. To amend S. W. L. Tariff No. 162 applying on **gravel, sand, stone,** etc., between points in the southwest, to include the Texas Electric Ry. as a participating carrier. S. W. L. Tariff 162 was issued in compliance with order of the Interstate Commerce Commission in Docket 17000. The Texas Electric Ry. was not a party to the original docket investigation, as that line was not a freight carrier when Docket 17000 was first filed. Since, however, the above tariff reflects the rates applicable in the territory of the Texas Electric Ry., it is proper for that line to be made a party thereto.

18743. **Sand and gravel,** between L. & A. Ry. points and points on the L. R. & N. of T. To amend Section 3 of Item 160 of S. W. L. Tariff 162, applying on sand and gravel, etc., by adding L. & A. Ry. and L. R. & N. Co. of Texas. At the present time the L. & A. and the L. R. & N. of T. are under the same management and control and desire that distance rates published in S. W. L. Tariff 162 be established between points on those lines for single line application.

WESTERN TRUNK LINE DOCKET

1564-U. **Stone, crushed,** carloads (See Note 3), but not less than 4000 lb., from Jasper, Minn., to Jefferson, S. D. Present—Combination basis. Proposed—$1.50 per ton of 2000 lb.

7059. Percentage allowance for drainage. Sand **and gravel,** washed, carloads, between points in W. T. L. territory. Present—No rule in effect. Proposed—To publish the following rule: "The following percentage allowance for drainage will be made on washed sand and gravel when weighed on privately owned track scales located at sand and gravel pits: Washed sand, 1%; washed gravel, ½%, except when covered by agreement with the Western Weighing and Inspection Bureau based on actual tests."

2556-L. **Sand,** from Browntown, Wis., to St. Paul and Minneapolis, Minn. Present rate, $2.40 per ton of 2000 lb. Proposed, $2 per ton of 2000 lb.

3234-E. **Sand,** carloads (See Note 2), except when shipment loaded to full visible capacity is less than 90% of marked capacity of car actual weight will apply. In no case shall the minimum weight be less than 40,000 lb., from Kansas City, Mo.-Kan., to Winfield, Kan. Present rates—From Kansas City, Mo., Class E; from Kansas City, Kan., 12c per 100 lb.; proposed, 9c per 100 lb.

7069. **Sand and gravel,** carloads (See Note 2), except that when weight of shipment loaded to full visible capacity of car is less than 90% of the marked capacity of the car the actual weight will apply, but in no case shall the minimum weight be less than 40,000 lb., from Cordova, Ill., to points in Iowa within 125 miles of Cordova. Present—Combination of locals. Proposed—Establish the Nebraska Joint Line Sand and Gravel Scale.

ILLINOIS FREIGHT ASSOCIATION DOCKET

4805-A. **Sand and gravel** (other than bank, glass, molding, silica, blast, core, engine, filtering, fire or furnace, foundry, grinding, polishing or loam sand), carloads, from Milwaukee, Wis., to Davenport, Ia. Rates per ton of 2000 lb. Present rate, $1.60; proposed, $1.30.

5267-A. **Crushed stone,** carloads (See Note 2), from Joliet, Ill., to Essex, Ill. Present rate, 88c; proposed, 76c.

5277. To establish commodity rate of $3.24 per net ton on **silica** (crude or ground), from Elco, Jonesboro, Kaolin, Mill Creek, Mountain Glenn, Murphysboro, Tamms and Whitehouse, Ill., to Sun Prairie, Wis.

5284. **Gravel pit strippings,** carloads (See Note 3), from Carpentersville, Ill., to Wayne and West Chicago, Ill. Rates per net ton. Present rate, 60c; proposed, 50c. (Rate to expire one year after effective date.)

5301. **Silica sand,** carloads, from Browntown, Wis., to Granite City and East St. Louis, Ill., and St. Louis, Mo. Present rate, $4.30; proposed, $2.24 per net ton.

5315. **Sand and gravel,** carloads, from Cordova, Ill., on C. M. & St. P. & P. Ry. to destinations on C. & N. W., C. B. & Q. and C. R. I. & P. Rys. in Illinois.

	Present Distance	Prop.
Combination of locals	5	80
Combination of locals	35	90
Combination of locals	60	110
Combination of locals	90	120
Combination of locals	125	120

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

18162. **Crushed stone** (traprock) (See Note 3), from Westfield, Mass., to Chester, Mass. Present, 85c per net ton; proposed, 60c per net ton. Reason—To meet motor truck competition.

18204. To extend the rates on **stone, broken or crushed,** in open cars (See Note 2), from Branford (Pine Orchard Quarry), Conn., East Haven, East Wallingford (Reed's Gap), Meriden (York Hill Quarry), Rocky Hill, Conn., and Westfield, Mass., to Auburn, Cranston, East Providence Wharf, Harbor Junction Wharf, Howard, Olneyville, Providence, River Point, Sockanossett, South Providence, Summit, Wickford Junction and Wood River Junction, R. I., until December 31, 1930, unless sooner canceled, changed or extended. Present rates now published to expire December 31, 1929. Reason—To meet competition by water and the highway.

18209. **Ground, unburnt or broken limestone,** from Cheshire, Farnams, North Adams, Renfrew, Richmond and Zylonite, Mass., to Troy, N. Y. Present rates, sixth class; proposed, 10c. Reason—To establish commodity rate on limestone relative to rate applied on lime.

TRUNK LINE ASSOCIATION DOCKET

22080. **Crushed stone,** carloads (See Note 2), from Spahr's, Md., to Kensington, Md., 95c per net ton. Present rate, $1.05 per net ton. Reason—Proposed rate is comparable with rates to Baltimore and Fort George G. Meade, Md.

22086. **Limestone, unburnt, ground,** carloads, minimum weight 50,000 lb., from Barber, Va., to Spring Mill Station, Penn., $3.30 per net ton. Present rate, $8.60 per net ton. Reason—Proposed

rate is fairly comparable with rate to Philadelphia, Penn.

22112. **Sand,** carloads, (A) open top equipment; (B) box cars or other closed equipment (See Note 2), to Cardiff, Md.:

From	Proposed (A)	Proposed (B)	Present (A)	Present (B)
Woodbury, N. J.	270	300	320	351
Manumuskin, N. J.	270	300	320	351
Muskee Siding, N. J.	270	300	320	351
Dorchester, N. J.	270	300	329	351
Cape May, N. J.	285	310	320	351

The above rates in cents per 2000 lb.

Reason—Proposed rates are fairly comparable with rates to Baltimore, Md.

CENTRAL FREIGHT ASSOCIATION DOCKET

23037. To establish on **stone,** viz.: **Rough, rubble, rip-rap and quarry scrap,** carloads, from McDermott and Roca, O., to Alexandria, Knightstown, Rushville and Greensburg, Ind., rate of $2.27 per net ton. Route—Via usual available routes. Present rate, 13c.

23040. To establish on **sand and gravel,** carloads, from Peru, Ind., to various points on Erie R. R. via N. Y. C. & St. L., Rochester, Ind., and Erie R. R. (present and proposed rates):

To—	Miles	Pres. Rate	Prop. Rate	Kickapoo Scale
Bippus, Ind.	56.6	*....	90	90
Servia, Ind.	50.5	*....	90	90
Bolivar, Ind.	48.1	*....	85	85
Newton, Ind.	46.3	*....	85	85
Laketon, Ind.	45.9	*....	85	85
Disko, Ind.	39.4	*....	80	80
Pershing, Ind.	29.2	*....	80	75
Leiter, Ind.	33.1	*....	80	80
Delong, Ind.	35.1	*....	80	80
Monterey, Ind.	39.0	*....	80	80
Ora, Ind.	42.7	*....	85	85
Bass Lake, Ind.	47.6	*....	85	85
Aldene, Ind.	49.3	*....	85	85

*Present rate—Sixth class.

23045. To establish on **sand and gravel,** carloads, from Lafayette, Ind., on the C. I. & L. Ry. to Gary, Ind., for Michigan Central R. R. delivery, via Michigan City, Ind., rate of 95c per net ton. Present rate, 16½c.

23048. To establish on **sand and gravel,** carloads, from Kent Sand and Gravel Pit, Ohio, to Painesville, Ohio, rate of 100c per net ton. Route—Via W. & L. E. Ry. and B. & O. R. R. Present rate, 13½c

23073. To establish on **sand, blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica,** carloads, from Wooster, O., to Canadian destinations, rates as shown in Exhibit B attached. Present rates—As shown in Exhibit B attached.

EXHIBIT "B"

Proposed Rates on Molding Sand From Wooster, Ohio.

Via Ashtabula, O., and Port Burwell, Ont.

To—	Sixth class rate	Proposed through rate	Proportion to Port Burwell	Proportion beyond Port Burwell
Brantford, Ont.	26½	359	189	170
Chatham, Ont.	23½	334	189	145
Galt, Ont.	26½	359	189	170
Guelph, Ont.	26½	359	189	170
Hamilton, Ont.	26½	359	189	170
Haspeler, Ont.	26½	359	189	170
Kitchener, Ont.	26½	359	189	170
London, Ont.	25	334	189	145
Owen Sound, Ont.	31½	499	189	310
Preston, Ont.	26½	359	189	170
St. Thomas, Ont.	25	334	189	145
Sarnia, Ont.	25	334	189	145
Toronto, Ont.	27½	399	189	210
Weston, Ont.	27½	399	189	210
Windsor, Ont.	22	.....	.....	.....
W. Toronto, Ont.	27½	399	189	210
Wingham, Ont.	30	499	189	310

Via Detroit, Mich.

To—	Proposed through rate	Proportion to Detroit	Proportion beyond Detroit	From Warwick, Ohio, pres. rate
Brantford, Ont.	359	189	170	359
Chatham, Ont.	334	189	145	.....
Galt, Ont.	359	189	170	.....
Guelph, Ont.	359	189	170	359
Hamilton, Ont.	359	189	170	359
Haspeler, Ont.	359	189	170	359
Kitchener, Ont.	359	189	170	359
London, Ont.	334	189	145	334
Owen Sound, Ont.	499	189	310	499
Preston, Ont.	359	189	170	359
St. Thomas, Ont.	334	189	145	334
Sarnia, Ont.	334	189	145	.....
Toronto, Ont.	399	189	210	399
Weston, Ont.	399	189	210	399
Windsor, Ont.	259	189	70	.....
West Toronto, Ont.	399	189	210	399
Wingham, Ont.	499	189	310	499

23051. To establish on **sand and gravel,** carloads, from Kalamazoo (County Spur), Mich., to Union Mills, Ind., rate of $1.05, and to Lottaville, Ind., rate of $1.15 per net ton. Present rates—There is no through rate, either class or commodity, in effect. The lowest rate legally applicable is made up as follows: Specific commodity rate to Mishawaka, Ind., 85c net ton, plus rate from Mishawaka to Chicago, Ill., $1.13 net ton, or a total of $1.98.

23067. To establish on **crushed stone,** carloads, from Keeport, Ind., to Cement City, Mich., rate of $1.35 per net ton, via Wabash-Alvordton, Ohio-Cincinnati Northern. Present rate, 18½c.

23068. To establish on **sand and gravel,** carloads, from Wapakoneta, O., to points in Ohio, rates as shown below (present and proposed rates, in cents per net ton):

To—	Proposed	Present
Delphos, O.	80	(1) $1.00
Kiefersville, O.	85	(2) 11½

(1) Rate from Dayton, O., applicable under intermediate rule.

(2) Sixth class.

23069. To establish on **crushed stone and crushed stone screenings,** carloads, from Bellevue, O., to Ravenna, O., rate of 90c. Present rate, 100c.

23085. To establish on **crushed stone,** in bulk, in open cars, **crushed stone screenings,** in bulk, in open cars, carloads, from Kenneth, Ind., to Wheatfield, Ind., rate of 90c per net ton. Present rate, 95c per net ton.

*23101. *Cancels W. D. A. 23049. To establish on **gravel and sand,** carloads, from Circleville, O., to points in Ohio, rates as shown below (in cents per net ton):

To—	Miles	Pres.	Pro.
Creola, O.	61	13½	90
Hamden, O.	73	13	95
Coalton, O.	81	13	100

Route—Lancaster, O., and H. V. Ry. Co.

23118. To establish on **sand and gravel,** carloads, from Troy, O., to points in Ohio, rates as shown below (per net ton):

To	Prop.	Pres.
Kiefersville, O.	$1.00	*$1.50
Continental, O.	1.05	* 1.50

*Rate from Cincinnati, O., applies under intermediate rule.

23143. To establish on **sand and gravel,** carloads, from Dundee, Ind., to Circleville, Ind., rate of 65c per net ton. Route—Via Nickel Plate direct. Present rate, 72c per net ton.

23144. To establish on **limestone screenings,** carloads, from Rock Point, Penn., to Frisco, Penn., rate of 40c per net ton. Present rate, 60c per net ton.

Silica Sand from Ottawa, Ill., District to Ohio Points

DISRUPTION of the blanket adjustment of rates on silica sand from the Ottawa, Ill., district to Ohio by the publication, by the Erie, effective July 10, of a rate of $2.52 on washed or processed silica sand and of $2.10 on crude silica sand to Marion, O., and points intermediate was given by the carrier representatives at the hearing at Chicago, October 29, before Examiner J. Edgar Smith, as the reason for the publication of the suspended tariff. The suspended tariff names a rate of $2.90 on both processed and crude sand to the Ohio points affected.

Testimony in support of that rate was presented by Irving L. Artes, representing all Central Freight Association lines, H. W. Schaffer, for the Rock Island and G. A. Hoffelder, for the Burlington. They showed that the proposed rate was applicable to a large blanket in Ohio, in which the Erie rates cut a deep gash nearly bisecting it, as represented on a colored map portraying the adjustment which was introduced. It was explained that the Erie rates had been published independently and that the suspended tariff restoring the adjustment was an effort to remove a situation prejudicial to other Ohio points, as well as prejudicial to other routes. The rate of $2.90 to the large Ohio blanket had been in effect since the 10% reduction in 1922, it was pointed out, and various comparisons of rates and earnings were introduced to substantiate the carrier contention that the proposed rate was not unreasonable. The railroad representatives considered the commodity of a comparatively high-grade nature, having a value ranging up to $5.50 and $7 a ton, and even higher.

Protesting shippers relied largely on the scale prescribed by the Commission in docket 17817, Sub. 1, Illinois Silica Sand Traffic Bureau against the Santa Fe and others, in which rates were prescribed on the movement from the Ottawa district to Indiana, Michigan, and other territory, which took effect August 30. Under that scale a rate of $2.52 on processed sand and of $2.10 on crude sand applied up to the Ohio-Indiana line. If that scale was reasonable up to the Ohio line, it was a fair measure of rates beyond, according to R. E. Riley, who testified in behalf of the Illinois Silica Sand Traffic Bureau. He said that the weighted average price for 1926, as shown in docket 17817, was 91 cents a ton, and that only a very small percentage of the total shipped had the high values referred to by the carrier representatives.

Harry E. Weldgen, testifying for the Ohio Steel Foundries, Lima, O., stated that the interests at Lima which he represented obtained sand in the Ottawa district from Utica, Weldron and Ottawa, and that, based on the average distance from those three points, the rates to Lima, under the 17817 scale, should be $2.40 and $2, on crude and processed sand, respectively. Referring to carrier testimony that maintenance of their revenues required the $2.90 rate at the Ohio points, he said that his company shipped only 50 cars in the period from July 10 to October 10, 1928, but that in the same period this year they had shipped over 400 cars, due to the reduction in rates.—*Traffic World.*

New Sandstone Quarry Planned at Tenino, Wash.

JOSEPH HENRITZI, Spokane mining man, has announced plans for developing a new sandstone quarry and the driving of an oil well on the J. C. Rambo place, a mile east of Tenino, Wash. The work is expected to proceed about the first of the new year, the development having been determined upon following an extended study of the property. Machinery for the quarry, a part of which will be purchased from the old Tenino Stone Co. plant belonging to Dr. D. G. Russell, will be installed about January 1. Other machinery will be shipped from Spokane. Drilling for oil, as soon as the quarry is in operation, is planned also.

The Rock Products Market

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in and less
EASTERN:						
Asbury Park, Farmingdale, Spring Lake and Wayside, N. J.	.48	.48	1.15	1.25	1.40	.....
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.25	1.15	1.75	.....	1.75	1.75
Buffalo, N. Y.	1.00	1.05	1.05	.....	.....	.....
Erie, Penn.	.60	.85	.....	1.30	1.30	1.30
Leeds Jct. and Scarboro, Me.	.....	.....	1.75	.....	1.25	1.00
Milton, N. H.	.....	.....	1.75	.....	1.25	1.00
Montoursville, Penn.	1.00	.75	.50	.40	.40	.40
Northern New Jersey	.50	.50	1.25	1.25	1.25	.....
South Portland, Me.	.....	1.00	2.25	.....	.....	2.00
Washington, D. C.	.60	.60	1.20	1.20	1.00	1.00
Georgetown, D. C.	.55	.55	1.20	1.20	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.35	.15	.25	.35	.35	.40
Appleton, Minn.	.....	.50	1.25	.....	1.50	.....
Attica, Ind.			All sizes .75–.85			
Barton, Wis.	.....	.40d	.50d	.65d	.65d	.65d
Des Moines, Iowa	.60	.60	1.50	1.50	1.50	1.50
Eau Claire, Chippewa Falls, Wis.	.....	.40	.55	.95	.85	.....
Elkhart Lake and Glenbeulah, Wis.	.60	.30	.50	.50	.50	.50
Grand Rapids, Mich.	.....	.50	.60	.70	.70	.70
Hamilton, Ohio	.....	.85	.85	.....	.85	.....
Hersey, Mich.	.....	.50	.....	.60	.70	.70
Indianapolis, Ind.	.50–.75	.40–.60	.50–.75	.50–.75	.60–.85	.60–.85
Mankato, Minn. (b)	.55	.45	1.25	1.25	1.25	1.25
Mason City, Iowa	.50	.50	.85	1.25	1.25	1.25
Milwaukee, Wis.	.91	.91	1.06	1.06	1.06	1.06
Minneapolis, Minn. (a)	.35	.35	1.35	1.35	1.35	1.25
St. Paul, Minn. (e)	.45	.35	.75	1.25	1.25	1.25
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Waukesha, Wis.	.....	.45	.55	.55	.60	.60
Winona, Minn.	.40	.40	.50	1.10	1.10	1.25
SOUTHERN:						
Brewster, Fla.	.40	.40	.....	.....	.....	.....
Charleston, W. Va.	.75	1.25	1.25	1.25	1.25	1.25
Eustis, Fla.	.....	.50	.....	.....	.....	.....
Ft. Worth, Texas	.75	.75	.90	1.00	1.10	1.10
Gainesville, Texas	.....	.....	.....	.....	.55	.....
Knoxville, Tenn.	.75–1.00	.75–1.00	.....	.....	1.20	1.05
Roseland, La.	.30	.30	1.00	.80	.80	.80
WESTERN:						
Los Angeles, Calif.	.10–.40	.10–.40	.20–.90	.50–.90	.50–.90	.50–.90
Oregon City, Ore.			All grades range from 1.00 to 1.50 per cu. yd.			
Phoenix, Ariz. (c)	1.25*	1.15*	1.50*	1.15*	1.15*	1.00*
Pueblo, Colo.	.70	.60	.....	1.25	.....	1.15
Seattle, Wash.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*

*Cubic yd. ‡Delivered on job by truck. (a) Per yd., delivered by truck, ¼-in. down, 1.25; 2-in. and less, 2.40. (b) ¼- to ¾-in., 1.25. (c) 60-70% crusher boulders. (d) Plus 15c for winter loading. (e) Prices f.o.b. cars N. P. Ry.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.10	2.00	2.25	.....	.....	4.25	.....
Beach City, Ohio	1.75	1.75	.....	1.50	1.50	.....	.....
Cheshire, Mass.			Sand for soap, 7.00–8.00			6.00–8.00	.....
Eau Claire, Wis.	.....	.....	.....	.....	.....	2.50–3.00	.....
Elco, Ill.	Water floated silica, 92-99½% thru 325 mesh, 18.00–40.00 per ton						
Franklin, Penn.	.....	1.75	.....	1.75	.....	.....	.....
Kasota, Minn.	.....	.....	.....	.....	.....	.....	1.00
Klondike, Mo.	2.00	.....	.....	2.00	2.00	.....	.....
Montoursville, Penn.	.....	.....	.....	1.25–1.60	.....	.....	.....
New Lexington, Ohio	2.00	1.50	.....	.....	.....	.....	.....
Ohlton, Ohio	1.75	1.75	.....	2.00	1.75	1.75	.....
Ottawa, Ill.	1.25	1.25	1.25	1.25	1.25	3.50	3.00
Red Wing, Minn. (a)	.....	.....	.....	.....	1.50	3.00	1.50
San Francisco, Calif.[1]	3.50†	5.00†		3.50†	3.50–5.00†	3.50–5.00†	3.50–5.00†	.....
Silica, Mendota, Va.				Potters' flint, 8.00–14.00			

†Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (a) Filter sand, 3.00.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio	.....	1.50
Eau Claire, Wis.	4.30	.60–1.00
Franklin, Penn.	.....	1.75
Ohlton, Ohio	1.75	1.75
Ottawa, Ill.	3.25	1.25
Red Wing, Minn.	.....	1.00
San Francisco, Calif.	3.50	3.50
Silica, Va.	.....	1.75

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Cheshire, Mass., in carload lots	5.00–7.00
Franklin, Penn.	2.25
Klondike, Mo.	2.00
Ohlton, Ohio	2.50
Ottawa, Ill.	1.25
Red Wing, Minn.	1.50
San Francisco, Calif.	4.00–5.00
Silica and Mendota, Va.	2.50–3.00

Bank Run Sand and Gravel

Prices given are per ton, f.o.b. producing plant or nearest shipping point.

City or shipping point	
Algonquin, Ill.¶ (2-in. and less)	.30
Appleton, Minn.†	.55
Burnside, Conn.†	.75*
Des Moines, Ia.¶ (1-in. and less)	.85
Fort Worth, Tex.¶ (2-in. and less)	.60
Gainesville, Tex.¶ (1½-in. and less)	.55
Gary and Miller, Ind.†	1.15–1.40a
Grand Rapids, Mich.¶ (1-in. and less)	.50
Hamilton, Ohio¶ (1½-in. and less)	.70
Hersey, Mich.¶ (1-in. and less)	.50
Mankato, Minn.†	.70
Seattle, Wash.—Sand, 1/10-in. down, .25*; ¼-in. and less, same; gravel in sizes ranging from 2-in. and less to ½-in. and less	.25*
Winona, Minn.¶ (2-in. and less)	.60
York, Penn. Sand, ¼-in. and less, 1.00; 1/10-in. down	1.10

*Cubic yard. †Fine sand, 1/-10-in. down. (a) Cu. yd., delivered Chicago. ¶Gravel.

Current Price Quotations

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations regularly. Price quotation blanks will be mailed, as heretofore, regularly every 6 weeks, with a return, stamped envelope.

Portland Cement

	Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M. (1) (2)	.91¼	3.65	.....
Atlanta, Ga. (1) (2)	.....	2.11	3.01¶
Baltimore, Md. (1)	.....	2.26	3.56¶
Birm., Ala. (1) (2)	.....	1.75	2.73¶
Boston, Mass.	.44½	‡1.78–1.88	3.27¶
Buffalo, N. Y.	.48¾	‡1.95–2.05	3.35¶
Butte, Mont.	.90¼	3.61	.....
Cedar Rapids, Ia.	.....	2.04	2.99f
Charleston, S. C. (2)	.....	2.40b	3.15¶
Cheyenne, Wyo. (1) (2)	.71½	2.86	.....
Chicago, Ill.	.....	1.85	3.15¶
Cincinnati, Ohio	.....	1.72	3.22¶
Cleveland, Ohio	.....	1.94	3.24¶
Columbus, Ohio	.....	1.72	3.22¶
Dallas, Texas	.....	1.80	3.39¶
Davenport, Iowa	.....	2.04	.....
Dayton, Ohio	.....	1.74	3.24¶
Denver, Colo. (1) (2)	.76¼	3.05	.....
Des Moines, Iowa	.....	2.14	2.99f
Detroit, Mich.	.....	1.95	3.25¶
Duluth, Minn.	.....	1.84	.....
Houston, Texas	.....	1.90	3.63¶
Indianapolis, Ind.	.54¾	1.69	f2.84–3.19¶
Jack., Miss. (1) (2)	.....	2.19	3.09¶
Jacksonville, Fla. (1) (2)	.....	2.36	3.26¶
Jersey City, N.J.(1)	.....	2.23	3.43¶
Kansas City, Mo.	.45½	1.82	f2.87–3.22¶
Los Angeles, Calif.	.51½	1.82	.....
Louisville, Ky.	.55½	1.72	f2.92–3.22¶
Memphis,T'n.(1)(2)	.....	2.19	f2.69–3.09¶
Milwaukee, Wis.	.....	2.00	3.30
Minneapolis, Minn.	.....	2.02	.....
Montreal, Que.	.....	1.60	.....
New Orleans, La.	.45½	‡1.88	3.18¶
New York, N.Y.(1)	.43¼	2.23	3.33¶
Norfolk, Va.	.....	1.77	3.27¶
Oklahoma City, Okla.	.57¼	2.16	3.56¶
Omaha, Neb.	.54	2.01	3.49¶
Peoria, Ill.	.....	2.02	.....
Pittsburgh, Pa. (1)	.....	2.25	3.35¶
Philadelphia, Pa.(1)	.....	2.25	3.45¶
Phoenix, Ariz.	.....	3.51	.....
Portland, Ore.	.....	2.30	.....
Reno, Nev. (2)	.....	2.82	.....
Richmond, Va.	.....	1.90	3.40¶
Salt Lake City, Utah	.70¼	2.81	.....
San Francisco(1)(2)	.....	2.60	.....
Savannah, Ga. (2)	.....	2.36a	3.15¶
St. Louis, Mo.	.48¾	1.70	f2.65–3.00¶
St. Paul, Minn.	.....	2.02	.....
Seattle Wash.	.....	2.65j	k3.50†
Tampa, Fla. (1) (2)	.....	2.40	3.30¶
Toledo, Ohio	.....	1.83	3.33¶
Topeka, Kan.	.50¼	2.01	3.41¶
Tulsa, Okla.	.53¼	2.03	3.43¶
Wheeling, W.Va. (1)	.....	2.32	3.42
Winston-Salem, N. C.	.....	1.84	3.34¶
Mill prices f.o.b. in carload lots, without bags, to contractors.			
Albany, N. Y.	.....	2.15	.....
Bellingham, Wash.	.....	2.35†	.....
Buffington, Ind.	.....	1.60	.....
Chattanooga, Tenn.	.....	2.05	.....
Concrete, Wash.	.....	2.25	.....
Davenport, Calif.	.....	2.05	.....
Hannibal, Mo.	.....	1.90	.....
Hudson, N. Y.	.....	1.75	.....
Leeds, Ala.	.....	1.65	.....
Lime & Oswego, Ore.	.....	2.40	.....
Mildred, Kan.	.....	2.35	.....
Nazareth, Penn.	.....	2.15	.....
Northampton, Penn.	.....	1.75	.....
Richard City, Tenn.	.....	2.05	.....
Steelton, Minn.	.....	1.65	.....
Toledo, Ohio	.....	2.20	.....
Universal, Penn.	.....	1.60	.....

NOTE—Add 40c per bbl. for bags. †10c disc., 10 days. ‡10c disc., 15 days. (a) With bags, 11c refund for paid freight bill. (b) With bags, 15c bbl. refund for paid freight bill. (1) Includes cloth bags at 40c. (2) 10c cash disc., 10c dealer discount. (f) "Velo" cement, including cost of paper bag, 10c disc. 10 days. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c disc. 15 days. (j) 25c bbl. disc. 10 days. (k) "Velo" cement, add 20c per bbl. for paper bags.

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chazy, N. Y.	.75	1.75	1.60	1.30	1.30	1.30
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Farmington, Conn.	.....	1.30	1.10	1.00	1.00	.....
Ft. Spring, W. Va.	.35	1.35	1.25	1.15	1.10	1.00
Munns, N. Y.	.75	1.15	1.15	1.00	1.00	.....
Prospect Jct., N. Y.	.80	1.15u	1.15u	1.15u	1.10v	.....
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
St. Vincent de Paul, Que. (n)	.65	1.25	1.05	.95	.85	1.00
Shaw's Junction, Penn. (e)	.85	1.35–1.60	1.35	1.35	1.35	1.35
Syracuse, N. Y.	.50	1.00	1.00	1.00	1.00	1.00
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Davenport, Iowa (f)	1.00	1.50	1.50	1.30	1.30	1.40
Dubuque, Iowa	.95	1.10	1.10	1.10	1.00	.....
Stolle and Falling Springs, Ill.	1.05–1.70	.95–1.70	1.15–1.70	1.05 1.70	1.05–1.70	.....
Greencastle, Ind.	1.25	1.10	1.10	1.10	1.10	1.10
Lannon, Wis.	.90	1.00	1.00	.90	.90	.90
McCook, Ill.	.75	.80	.80	.80	.80	.80
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Stone City, Iowa	.75	.....	1.20	1.05	1.00	.....
Toronto, Canada	2.50	2.50	2.50	2.50	2.50	.....
Waukesha, Wis.	.....	.90	.90	.90	.90	.90
Wisconsin points	.50	.....	1.00	.90	.90	.....
Youngstown, Ohio	1.00	1.00	1.25	1.25	1.25	1.25
SOUTHERN:						
Cartersville, Ga.	1.00	1.65	1.65	1.35	1.15	1.15
Chico, Texas (a)	.50	1.30	1.30	1.25	1.20	1.00
Cutler, Fla.	.....	.50– .75r	.....	1.50–1.75r	.....	1.10r
El Paso, Texas (r)	.75–1.00	1.00–1.25	1.00–1.25	1.00	1.00	1.00
Olive Hill, Ky.	.....	1.00	1.00	.90	.90	.90
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.70
Blue Springs and Wymore, Neb. (t)	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.00	1.25	1.25	1.25	1.00	.....
Rock Hill, St. Louis, Mo.	1.45	1.45	1.45	1.45	1.45	1.45
Stringtown, Okla. (a)	.50	1.30	1.30	1.25	1.20	1.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35	.....	1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Chico, Texas	2.50	2.00	1.45	1.20	1.15	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	2.00	1.45	1.25	1.20	1.00
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	1.35–1.40	2.00–2.10	1.80–1.90	1.40–1.50	1.40–1.50	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
Toronto, Canada	4.70	5.80	.....	4.05	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Cayce, S. C.—Granite	.....	.....	1.75	1.60	1.60	.....
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.—Flint rock	.....	.....	2.25–2.50s	.....	.....	.....
Lithonia, Ga.—Granite	.50	1.75	1.60	1.35	1.25	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00–3.50	.....	2.00–2.25	2.00–2.25	.....	1.25–3.00
Richmond, Calif.—Quartzite	75	.....	1.00	1.00	1.00	.....
Toccoa, Ga.—Granite	1.50	.....	1.50	1.35	1.30	1.25

(a) Limestone, ¼ to ⅛ in., 1.35 per ton; Lime flour, 8.50 per ton. (b) To ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Price net after 10c cash discount deducted. (f) High calcite fluxing limestone, 92-98% CaCO, 1.75. (n) Ballast R. R., .90; run of crusher, 1.00. (q) Crusher run, 1.40; ¼-in. granolithic finish, 3.00. (r) Cubic yard. (s) 1-in. and less, per cubic yard. (t) Rip rap, 1.20–1.40 per ton. (u) Less 2%, 15 days. (v) Less 2%, 10 days.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Erie and Du Bois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern New Jersey	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.00	1.00	.....	1.00	.....	.....	.....
Western Pennsylvania	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	.....	1.30*	.....	1.45*	1.45*	1.45*	.....
Jackson, Ohio	.....	1.05*	1.80*	1.45*	1.05*	1.30*	.....
Toledo, Ohio	1.50	1.10	1.25	1.25	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	.....	1.45*	1.80*	1.45*	1.45*	1.45*	.....
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.80
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.05
Woodward, Ala.†	2.05	.55*	.....	1.15*	.90*	.90*	.....

5c per ton discount on terms. †1¼ in. to ¼ in., $1.05; ¾ in. to 10 mesh, $1.25*; ⅝ in. to 0 in., .90*; ¼ in. to 10 mesh, .80*.

Agricultural Limestone
(Pulverized)

Alton, Ill.—Analysis, 99% $CaCO_3$; .03% $MgCO_3$; 90% thru 100 mesh 2.95

Branchton, Penn.—100% thru 20 mesh, 60% thru 100 mesh, 45% thru 200 mesh a5.00

Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh 1.50

Cartersville, Ga.—90% thru 100 mesh, 2.00; 50% thru 50 mesh 1.50

Cypress, Ill.—Analysis, 94-98% $CaCO_3$, 2% $MgCO_3$; 90% thru 100 mesh, 1.35; 50% thru 100 mesh, 1.15; 90% thru 50 mesh, 1.15; 50% thru 50 mesh, 1.05; 90% thru 4 mesh, 1.10; 50% thru 4 mesh 1.00

Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 200 mesh, bags, per ton 6.00
90% thru 20 mesh, bulk, per ton 1.50

Joliet, Ill.—Analysis, 52% $CaCO_3$; 48% $MgCO_3$; 90% thru 100 mesh 3.50

Knoxville, Tenn.—Analysis, 52% $CaCO_3$; 36% $MgCO_3$; 80% thru 100 mesh, bags, 3.75; bulk 2.50

Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton 2.00

Marlbrook, Va.—Precipitated Lime) Analysis, 92% $CaCO_3$; 2% $MgCO_3$, 50% thru 50 mesh; bulk, 2.25; bags 4.50

Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh 4.25

Olive Hill, Ky.—Analysis, $CaCO_3$ 94-98%; 90% thru 4 mesh 1.00

Sibley, Mich.—Analysis, 87.47% $CaCO_3$; 8.30% $MgCO_3$; 60% thru 100 mesh, bulk, per ton, 2.30; 100-lb. paper bags, f.o.b. Sibley, Mich., per ton 3.75

(a) Less 50c comm. to dealers per ton.

Agricultural Limestone
(Crushed)

Bedford, Ind.—Analysis, 98½% $CaCO_3$; ½% $MgCO_3$; 90% thru 10 mesh 1.50

Chico and Bridgeport, Tex. — Analysis, 95% $CaCO_3$; 1.3% $MgCO_3$; 90% thru 4 mesh 1.00–1.25

Charles-Town, W. Va.—Lime Marl—Analysis, 95% $CaCO_3$, 50% thru 100 mesh, bulk, 3.00; including burlap bags 4.50

Colton, Calif.—100% thru 16 mesh, bulk, 4.00; including sacks 5.00

Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 10 mesh, per ton 1.25
90% thru 4 mesh, per ton 1.10

Dubuque, Ia.—Analysis, 34.96% $CaCO_3$; 59.62% $MgCO_3$; 90% thru 4 mesh ..... .95

Dundas, Ont.—Analysis, 54% $CaCO_3$; 43% $MgCO_3$; 50% thru 50 mesh 1.00

Fort Spring, W. Va.—Analysis, 40% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh 1.50

Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh, sacked 5.00

Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh 2.00
Screenings (¼ in. to dust) 1.00

Marblehead, Ohio—90% thru 100 mesh 3.00
90% thru 50 mesh 2.00
90% thru 4 mesh 1.00

McCook and Gary, Ill.—Analysis, 63% $CaCO_3$, 37% $MgCO_3$; 90% thru 4 mesh ..... .90

Middlepoint, Bellevue, Bloomville, Kenton and Whitehouse, Ohio; Monroe, Mich.; Bluffton, Greencastle and Kokomo, Ind. —85% thru 10 mesh, 25% thru 100 mesh 1.50

Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh 1.15–1.70

Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh ..... .75

West Stockbridge, Mass.* — Analysis, 95% $CaCO_3$; 90% thru 100 mesh, bulk 3.50
100-lb. paper bags, 4.25; cloth 5.25

Waukesha, Wis.—90% thru 100 mesh, 4.00; 50% thru 100 mesh 2.10

*Less 25c cash 15 days.

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 5.10; bulk 3.50

Joliet, Ill.—Analysis, 50% $CaCO_3$; 42% $MgCO_3$; 98% thru 100 mesh; 90% thru 200 mesh (bags extra) 3.50
bulk 4.00

Piqua, Ohio—99% thru 100 mesh, bulk, 3.50; in 80-lb. bags (f.o.b. Piqua) 5.00

Rocky Point, Va.—Analysis, 97% $CaCO_3$; 75% $MgCO_3$; 85% thru 200 mesh, bulk 2.25–3.50

Waukesha, Wis.—90% thru 100 mesh, bulk 4.00

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00			17.50		2.00
Buffalo, N. Y.				12.00				
Lime Ridge, Penn.	10.00	10.00	10.00		6.00	8.00	5.00	
CENTRAL:								
Afton, Mich.						10.75	7.50	12.11
Carey, Ohio	9.50	6.50	6.50		8.00		8.00	1.50
Cold Springs, Ohio		6.50	6.50				8.00	
Gibsonburg & Whiterock, O.	9.50		6.50		8.00	10.00	8.00	
Huntington, Ind.		6.50	6.50					
Marblehead, Ohio		6.50	6.50				7.00	1.50[3]
Scioto, Ohio	10.50	7.50	7.50	8.50	8.25	.62½	7.00	1.50
Sheboygan, Wis.		10.50	10.50	10.50			9.50	2.00
Tiffin, Ohio					8.00	10.00		
Wisconsin points		11.50					9.50	
Woodville, Ohio[26]	9.50	6.50	6.50	10.50[24]	8.00	10.00[9]	8.00	1.40[3]
SOUTHERN:								
Keystone, Ala.	17.00	9.00	9.00	8.00–12.00			6.00[21]	1.35
Knoxville, Tenn.		9.00	7.50	7.50			5.00[1]	1.25[2]
Ocala, Fla.		11.00						1.45
WESTERN:								
Kirtland, N. M.							15.00	
San Francisco, Calif.	19.50	15.00	13.00	15.00–19.00	14.50[20]	.90[17]	14.50[19]	1.85[17]

[1]Also 6.00. [2]To 1.35. [3]Wooden, steel, 1.60. [9]80-lb. [17]Less credit for return of empties. [19]To mortar plant and large industrials, 13.00. [20]Also 13.00. [21]To 8.00. [24]Superfine, 99.25% thru 200 mesh. [26]General purpose hydrated lime in 10-lb. paper sacks, 12.50 per ton.

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 200 mesh (94-96% thru 300 mesh), $7.00 per ton in paper bags.

Slate Granules

Esmont, Va.—Blue, $7.50 per ton.
Pen Argyl, Penn.—Blue-black, 6.50 per ton.
Granville, N. Y.—Red, green and black, $7.50 per ton.

Roofing Slate

City or shipping point:	Prices per square—Standard thickness. 3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Arvonia, Va.—Buckingham oxford grey..	13.88	19.44	24.99	29.44	34.44	45.55
Bangor, Penn.—No. 1 clear	10.50–14.50	24.50	29.00	33.50	44.50	55.60
No. 1 ribbon	9.00–10.25	20.00	24.50	29.00	40.00	51.25
Sea Green No. 1	10.00–14.00	20.00	25.00	30.00	40.00	50.00
Mottled Purple	14.75–19.00	24.00	30.00	36.00	48.00	60.00
No. 1 Albion clear	9.00–10.50	16.00	23.00	27.00	37.00	46.00
Chapman Quarries, Penn.—No. 1	8.50–11.25		(Vari-tone, 12.00–13.00)			
Medium	7.75– 9.00					
Hard vein		16.00	23.00	26.00	32.00	40.00
Granville, N. Y.—Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green and gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple and unfading green	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Monson, Maine	19.80	24.00				
Pen Argyl, Penn.*						
Graduated slate (blue)		16.00	23.00	27.00	37.00	46.00
Graduated slate (grey)		18.00	25.00	29.00	39.00	48.00
Color-tone	11.50–12.50; Vari-tone, 12.00–13.00; Cathedral gray, 14.00–15.00					
No. 1 clear (smooth text)	7.25–10.50; No. 1 clear (rough text), 8.25–9.50					
Albion-Bangor medium	8.00–9.00; No. 2 clear, 8.00–9.00; No. 1 ribbon, 8.00–8.50					
Slatedale and Slatington, Penn.—						
Genuine Franklin	11.25	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1	10.50	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1 clear	9.50	18.00	22.00	26.00	36.00	46.00
Blue Mountain No. 2 clear	8.00	18.00	22.00	26.00	36.00	46.00

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.
*Unfading grey, 10.50–12.50; textural, 12.00–15.00; 10% disc. to roofer; 10%–8⅓% to wholesaler.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:	
Crude talc, per ton	5.00
Ground talc (20-50 mesh), bags	6.50
Ground talc (150-200 mesh), bags	9.00
Pencils and steel crayons, gross	1.50– 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), paper or burlap bags, bags extra	7.50– 8.50
Same, including 50-lb. Kraft paper bags	8.50– 9.50
Clifton, Va.:	
Crude talc, per ton	4.00
Ground talc (150-200 mesh), in bags	12.00
Conowingo, Md.:	
Crude talc, bulk	4.00
Ground talc (150-200 mesh), in bags	14.00
Cubes, blanks, per lb.	.10
Emeryville, N. Y.:	
Ground talc (200 mesh), bags	13.75
Ground talc (325 mesh), bags	14.75
Hailesboro, N. Y.:	
Ground talc (300-350 mesh) in 200-lb. bags	15.50–20.00
Henry, Va.:	
Crude (mine run)	3.50– 4.50
Ground talc (150-200 mesh), bags	8.75–14.00
Joliet, Ill.:	
Ground talc (200 mesh) in bags:	
California white	30.00
Southern white	20.00
Illinois talc	10.00
Crude talc	3.75
Los Angeles, Calif.:	
Ground talc (150-200 mesh) in bags	15.00–24.00
Natural Bridge, N. Y.:	
Ground talc (300-325 mesh), bags	12.00–15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-68%	3.75– 4.25
Mt. Pleasant, Tenn.—B.P.L., 75%	6.50

Ground Rock (2000 lb.)

Gordonsburg, Tenn.—B.P.L. 65–70%	3.75– 4.50
Mt. Pleasant, Tenn.—Lime phosphate:	
B.P.L., 73%, 80% thru 300 mesh	11.80
Mt. Pleasant, Tenn.—B.P.L., 72%	5.00– 5.50

Florida Phosphate

(Raw Land Pebble) (Per Ton)

Florida—F.o.b. mines, gross ton, 68/66%	
B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	100.00–125.00
Punch mica, per lb.	20c
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—Per ton,	
Mine run	300.00–360.00
Clean shop scrap	27.50–29.00
Mine scrap	22.50
Roofing mica	a37.50–40.00
Punch mica, per ton	200.00–240.00
Trimmed mica, per ton, 40 mesh, 42.50–45.00; 100 mesh, 60.00; 200 mesh	100.00
Trenton, N. J.—Mine scrap, per ton	20.00
Clean shop scrap, per ton	22.00

(a) Also 38.00–42.50 per ton.

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ½x32x 36". Per M Sq. Ft.	⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10". Per M Sq. Ft.
Acme, Tex.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Blue Rapids, Kan.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Centerville, Iowa			6.00	7.00		7.50	8.50	10.50a					
East St. Louis, Ill.—Special Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton; floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 3 in. long, 17c per ft., 23.00 per ton.													
Ft. Dodge, Iowa; N. Holston, Va.; Akron, N. Y.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Grand Rapids, Mich.			7.00d		8.00d	8.00d	19.85c	8.00d	29.25e	21.00d		15.00	22.50
Los Angeles, Calif. (b)		6.50–7.50	6.50–7.50	7.50–9.00	13.10–14.10		14.10		26.00				
Medicine Lodge, Kan.	1.40								15.00y				
Portland, Colo.		7.00	7.00	9.00	9.00	9.50	9.00		27.50		22.50	27.50	
Providence, R. I. (x)				12.00–13.00e									
Seattle, Wash. (z)	6.00	9.00	9.00	13.00			14.00						
Winnipeg, Man.	5.00		7.00	13.00	14.00	14.00					20.00w	25.00g	33.00f

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) White molding. (b) Plasterboard, 18½c to 25c sq. yd. (c) Satin Spar, in paper bags. (d) Includes paper bags. (e) Includes jute sacks. (f) "Gyproc," ⅜ in. by 48 in. by 5 and 10 ft. long. (g) ⅜ in. by 48 in. by 3 to 4 ft. (w) 16x48. (x) "Fabricaste" gypsum blocks, 2- and 3-in., f.o.b. motor trucks at plants, 7¼c-8¼c. Block setting plaster, per ton, in jute sacks, 12.00. (y) Jute sacks, 18.00; paper sacks, 16.00. (z) Gypsum partition tile, 3-in., 9c per sq. ft.; 4-in., 11c per sq. ft.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream, and American Botticino, coral pink, pearl blush	¶12.50–‖14.50	¶12.50–‖14.50
Cranberry Creek, N. Y.—Bio-Spar, per ton in bags in carload lots, 9.00; less than carload lots, 12.00 per ton in bags; bulk, per ton		7.50
Crown Point, N. Y.—Mica Spar		¶9.00–‖12.00
Easton, Penn.—Royal green	16.00–20.00a	
Middlebrook, Mo.—Red		20.00–25.00
Middlebury, Vt. — Middlebury white		‖9.00–¶10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50
Phillipsburg, N. J.—Royal green granite		15.00–18.00
Randville, Mich.—Crystalite white marble, bulk	4.00	4.00– 7.00
Stockton, Calif.—"Nat-rock" roofing grits		12.00–20.00
Tuckahoe, N. Y.—Tuckahoe white	8.00	
Warren, N. H.		7.90– 9.50

¶C.L. ‖L.C.L. (a) Including bags. (b) In burlap bags, 2.00 per ton extra. *Per 100 lb.

Soda Feldspar

DeKalb Jct., N. Y.—Color, white; pulverized, 200 mesh, in bags, per ton, 20.00; bulk 18.00; 140 mesh, in bags, ton, 18.00; bulk	16.00

Potash Feldspar

Auburn and Topsham, Me.—Color white, 98% thru 140-mesh	19.00
Bedford Hills, N. Y.—Color, white; analysis, K_2O, 12.26%; Na_2O, 2.86%; SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; pulverized 78% thru 100 mesh, bulk, 11.00–14.00; crude, bulk, per ton	9.00
Coatesville, Penn.—Color, white; analysis, K_2O, 12.30%; Na_2O, 2.86% SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; crude, per ton	8.00
Trenton, N. J.—White; analysis, K_2O, 13-14%; Na_2O, 2-2½%; SiO_2, 64-65%; Fe_2O_3, 0.07%; Al_2O_3, 18.50-19.25%; pulverized, 97% thru 325 mesh, crude, 8.50 per ton, ground	21.00
Rumney and Cardigan, N. H.—Color, white: analysis, K_2O, 9-12%; Na_2O, trace; SiO_2, 64-67%; Al_2O_3, 17-18%, crude, bulk	7.00– 7.50
Rumney Depot, N. H.—Color, white; analysis, K_2O, 8-13%; Na_2O, 1-1½%; SiO_2, 62-68%; Al_2O_3, 17-18%, crude, bulk	7.00– 7.50
Penland, N. C.—White; crude, bulk	8.00
Ground, bulk	16.50
Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; pulverized, bulk	18.00
(Bags 15c extra.)	

Chicken Grits

Centerville, Iowa	9.25
Chico, Tex.—Hen size and Baby Chick, packed in 100-lb. sacks, per ton	10.00
Coatesville, Penn.—(Feldspar), per ton, in bags of 100 lb. each	8.00
Davenport, Ia.—(Limestone), bags, per ton	6.00
Los Angeles, Calif.—Per ton, including sacks: Gypsum	7.50– 9.50
Middlebury, Vt.—Per ton (a)	10.00
Randville Mich.—(Marble), bulk	6.00
Seattle, Wash.—(Gypsum), bulk, ton	10.00
Warren, N. H.	8.50– 9.50
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.	7.50– 9.00
Wisconsin Points—(Limestone), per ton	15.00

(a) F.o.b. Middlebury, Vt.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Dayton, Ohio	12.50–13.50
Detroit, Mich. (d)	e13.00–16.00*b
Farmington, Conn.	16.00
Grand Rapids, Mich.*	14.00–15.00
Jackson, Mich.	13.00
Lake Helen, Fla.	8.50– 9.00
Madison, Wis.	12.50a
Mishawaka, Ind.	11.00
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	10.00*
New Brighton, Minn.	10.00
Pontiac, Mich.	15.50
Portage, Wis.	15.00
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	12.50
Sebewaing, Mich.	12.50
South St. Paul, Minn.	9.00
Syracuse, N. Y.	18.00–20.00
Toronto, Canada (f)	g12.50–15.00c
Winnipeg, Canada	15.00

Delivered on job. (a) Less 50c disc. per M 10th of month. (b) 5% disc., 10th of month. (c) Delivered in city. (d) Also 15.50. (e) Also 14.00. (f) Also 14.00, f.o.b. city jobs. (g) F.o.b. yard.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

City or shipping point	Size 8x8x16
Camden, N. J.	16.50
Chicago District	180.00–210.00a
8x10x16	230.00–260.00a
8x12x16	280.00–330.00a
Columbus, Ohio	13.00b– 15.00†
Forest Park, Ill.	21.00*
Grand Rapids, Mich.	11.00*
Graettinger, Iowa	.18– .20
Indianapolis, Ind.	.10– .12a

*Price per 100 at plant.
†Rock or panel face.
(a) Face. (b) Plain.

Cement Building Tile

Camden and Trenton, N. J.: 3x8x16, per 100, 9.00; 3x9x16, per 100	9.00
4x8x16, per 100, 12.00; 4x9x16, per 100	13.00
6x8x16, per 100, 16.50; 6x9x16, per 100	15.50
Chicago District (Haydite): 4x 8x16, per 100	13.00
8x 8x16, per 100	20.00
8x12x16, per 100	28.00
Columbus, Ohio: 5x8x12, per 100	6.00
Grand Rapids, Mich.: 5x8x12, per 100	6.00
Houston, Texas: 5x8x12 (Lightweight), per M	80.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Camden & Trenton, N. J.	17.00	
Chicago District "Haydite"	14.00	
Columbus, Ohio	16.00	17.00
Ensley, Ala. ("Slagtex")	12.50	
Forest Park, Ill.		37.00
Milwaukee, Wis.	14.00	31.50
Omaha, Neb.	17.00	30.00– 40.00
Philadelphia, Penn.	15.50	
Portland, Ore.	12.00	22.50–55.00
Prairie du Chien, Wis.	14.00	22.00–25.00
Rapid City, S. D.	18.00	30.00– 40.00

Cement Drain Tile

Graettinger, Iowa.—Drain tile, per foot: 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in., .35; 18-in., .50; 20-in., .60; 24-in., 1.00; 30-in., 1.35; 36-in.	2.00
Tacoma, Wash.—Drain tile, per 100 ft. 3-in.	4.00
4-in.	5.00
6-in.	7.50
8-in.	10.00

Cement Price Discounts

STEPS have been taken toward removing the most controverted point between contractors and the cement industry. The contractors have long complained over what they regarded as preferential discounts extended by cement dealers to public bodies. In this manner, it has been complained, municipalities have bought cement at lower rates than those for which the contractors are able to get it, thus encouraging the undertaking of public construction work with day labor. Negotiations are under way with leading cement manufacturers and dealers to devise some means of correcting this situation.—*Engineering News-Record.*

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.: Red	15.00
Green	18.00
Cicero, Ill.—French and Spanish tile (red, orange, choc., yellow, tan, slate, gray) per sq., 9.50–10.00; green or blue, per sq.	11.50–12.00
Detroit, Mich.—5x8x12, per M	67.50
Houston, Texas—Roofing Tile, per sq.	25.0c
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00

Note—Bags extra and returnable for full credit.

Stone-Tile Hollow Brick

Prices are net per thousand f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Asheville, N. C.	35.00	50.00	60.00
Atlanta, Ga.	29.00	42.50	53.00
Brownsville, Tex.		53.00	62.50
Brunswick, Me.†	40.00	60.00	80.00
Charlotte, N. C.	35.00	45.00	60.00
De Land, Fla.	30.00	50.00	60.00
Farmingdale, N. Y.	37.50	50.00	60.00
Houston, Tex.	35.00	45.00	60.00
Jackson, Miss.	45.00	55.00	65.00
Klamath Falls, Ore.	65.00	75.00	85.00
Longview, Wash.		55.00	64.00
Los Angeles, Calif.	29.00	39.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	50.00	55.00	65.00
Mineola, N. Y.	45.00	50.00	60.00
Nashville, Tenn.	30.00	49.00	57.00
New Orleans, La.	35.00	45.00	60.00
Norfolk, Va.	35.00	50.00	65.00
Passaic, N. J.	35.00	50.00	65.00
Patchogue, N. Y.		60.00	70.00
Pawtucket, R. I.	35.00	55.00	75.00
Safford, Ariz.	32.50	48.75	65.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% disc.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8-in.	10 in.	12 in.	15-in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Grand Rapids, Mich. (b)	.....	.....	.....	.60	.76	.90	1.20	.....	.....	1.80	2.10	2.35	3.50	4.00	5.60	6.90	7.85
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	1.70†	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.75	.85	.90	1.15	.....	.....	1.60	.....	2.50	.....	.....	.....	.....	.....
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Tiskilwa, Ill. (rein.)	.....	.....	.....	.75	.85	.95	1.20	1.60	.....	2.00	.....	2.75	3.40	.....	6.50	.....	10.00
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	.85½	.....	1.14	.....	.....	1.81	.....	2.47	3.42	4.13	5.63	6.49	7.31

(a) 24-in. lengths. (b) Reinforced. †21-in. diameter.

New Machinery and Equipment

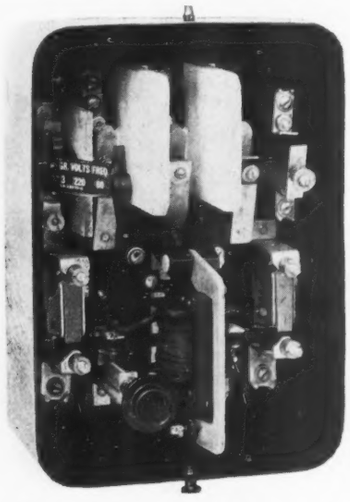
New Differential Chain Hoist

A NEW differential chain hoist, manufactured in five sizes, with capacities ranging from ¼- to 2-tons, is announced by Robbins and Myers, Inc., Springfield, Ohio. Timken thrust bearings are used in the lower hook. The sheaves are of Aremite, an alloyed iron produced in the Robbins and Myers foundry, which, because of high tensile strength and hardness, is claimed to be remarkably durable. Aluminum finish is used throughout, chains excluded, to provide protection against damage from exposure. The chains are of a special analysis steel, heat treated and electrically welded.

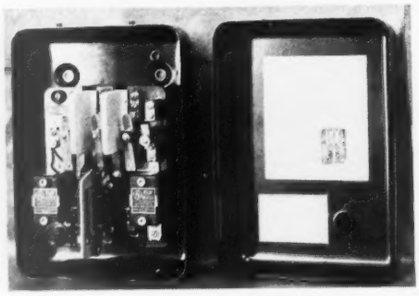
Two New Types of Magnetic Switches

THE General Electric Co., Schenectady, N. Y., has announced the addition of two new switches to its general line of general-purpose starters for small alternating current motors. The CR-7006-D-26-A is a three- and four-pole magnetic switch with self-contained "Start" and "Stop" stations, and the CR-7006-D-26-D is a switch for similar service but especially designed to provide plenty of wiring space.

The CR-7006-D-26-A is of standard design incorporating features for overload protection and undervoltage protection or release. It is used for starting and protecting



New magnetic switch for small a.c. motors



Magnetic switch with overload protective features

small alternating-current motors that can be thrown directly on the line. It consists of a triple-pole, barrier-type contactor and a double-coil temperature overload relay, all mounted on a molded base in a drawn-shell steel enclosing case. Added to these are starting and stopping contacts ordinarily provided by a remote-control push-button station. It is expected to be of particular value when used in installations where it is desired to locate magnetic switches at the driven machines, making remote push-button control unnecessary.

The CR-7006-D-26-D, although for the same general class of application, is designed for use with remote push-button stations. Its principal advantage is the large amount of wiring space provided. Mechanically, the switch mechanism is located below the center of the box to prevent interference with the mounting holes. This construction also allows plenty of room for the arc, preventing flashovers, it is claimed.

New Reversing Drum Controller

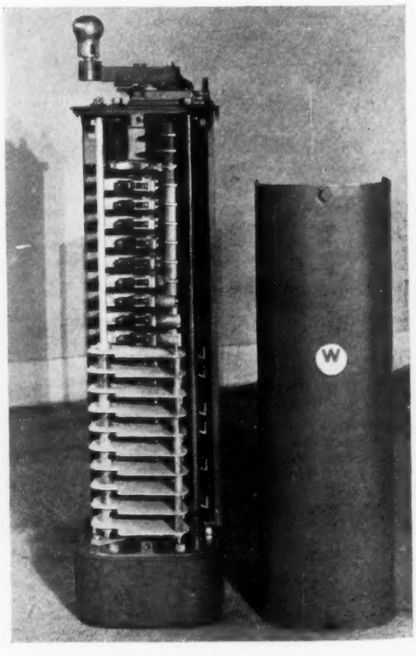
A NEW LINE of reversing drum controllers is announced by the Westinghouse Electric & Manufacturing Co., to be known as Type A controller, and listed in classes 8300 and 8400 for d. c. service, and in classes 12-700 and 12-800 for a. c. service. They are designed for heavy usage in operating cranes, hoists, bending rolls, and the like and incorporate several new features and refinements in design and operation.

In construction castings have been replaced by steel parts wherever practicable to provide maximum strength with reduced size. The wiring of this controller is claimed to be unusually simple because of its removable back cover, its ample wiring space behind the rotating contacts and its large openings in the base. For safety a simple latch is located in the handle to prevent its unintentional moving by an accidental knock, and unauthorized operation is eliminated by a handle lock.

Large Capacity Semi-Revolving Electric Shovel

THE NEW Marion type 6200 has been designed as a fast, mobile power shovel of sufficient range and capacity to meet the demands for a large excavator with a comparatively low operating cost, according to the manufacturers. Speed, it is claimed, has been obtained by having a minimum of rotating parts; only the boom, dipper and handle, hoist machinery rotating. Further, the entire hoisting unit is mounted on the swing circle. These two features are said to permit a rapid hoist, fast swinging and because of low inertia, controlling and spotting is accomplished easily, the manufacturers state.

The new machine is equipped with an entirely separate propelling unit mounted rigidly on lower frame and under separate control. The power from the motor is conveyed through a gear train to two semi-rigid crawlers. These crawlers have a three-point bearing to allow for inequalities of the pit floor, but otherwise are similar to the rigid crawlers of the small revolving shovels. The



Reversing drum controller for crane and hoist operation

object of this design was to permit ease of handling in the pit—a short turning radius and faster propelling.

Standard equipment with the type 6200 is a 5 cu. yd. dipper. The swing is 220 deg., a feature which permits digging or loading back of the center line of rotation.

One shovel has been put in the field and another will soon be erected, it is said.

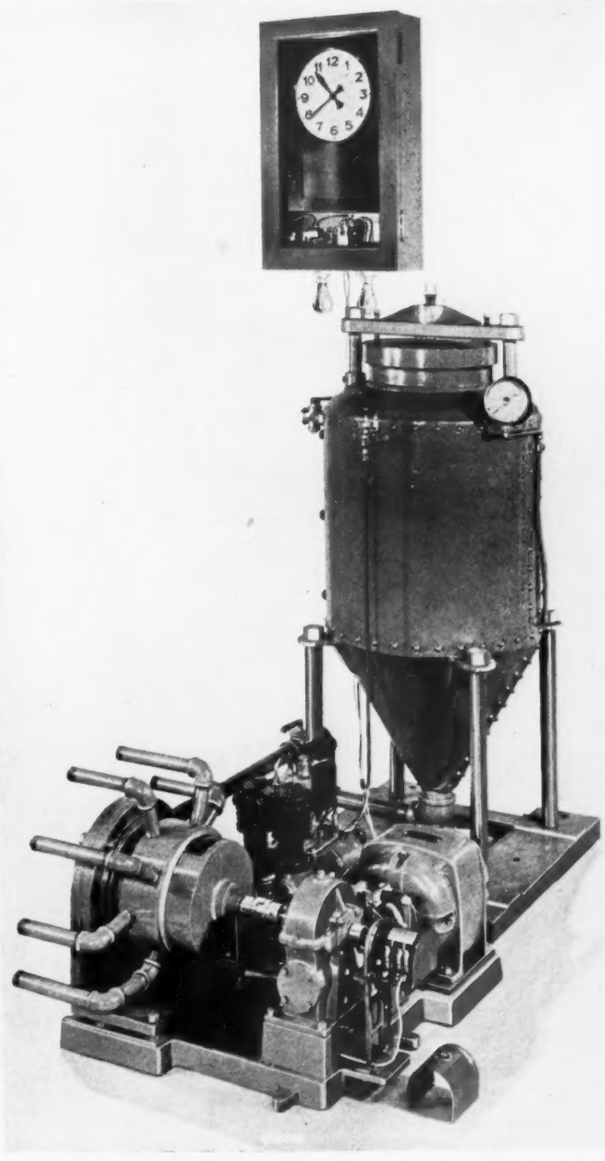
Armored Cables of Large Diameters Now Available

POWER and control cable with interlocked, flexible metal armor for installation without a conduit in central station, industrial and other interior wiring has been announced by the General Electric Co., Schenectady, N. Y. Cable provided with the armor can be run along walls, between partitions and under floors without the use of ducts, and the construction of the armor is such that turns in the cable can be made easily.

Varnished cambric and rubber-insulated, either taped, braided or leaded, and paper-leaded cable can be supplied with the armor, in lengths up to 1000 ft. for cables with an overall diameter less than 1 in. and in lengths up to 2000 ft. for cables with an overall diameter between 1 and 3 in. The cables can have any number and combination of conductors, and any outside diameter up to 3 in.

The armor is a layer of overlapping and interlocking metal tape, either galvanized steel or aluminum, so applied that the cable is always mechanically protected under reasonable installation conditions. The steel armor is suitable for most installations; the aluminum tape is for use where a non-corroding armor is required, and for single conductor cable carrying current where the magnetic effect of steel is undesirable.

Wagon-mounted hammer drill working in a quarry



Automatic lubrication system with electric clock control

Wagon-Mounted Hammer Drill

A NEW type wagon-mounting for accommodation of light and heavy drifter drills is announced by the Ingersold-Rand Co., New York. The new mounting is compact and self-contained, light in weight and comprises a wagon equipped with steel wheels, two in the rear and one in the front.

Besides the necessary slabback, slabback guide, etc., for the mounting of the drill, the outfit is equipped with a water tank; a hoist or winch for raising drill and changing steels; a centralizer for the steel to insure easy starting of the hole, and other refinements which provide for blowing and cleaning the hole, regardless of the position of the drill on the slabback guide. A steel rack and an upright extension for handling steel over 18 ft. can also be furnished if desired.

The outfit is claimed particularly suitable for soft to medium-hard rock formations.

Automatic Lubrication System

A PERFECTED automatic grease lubricating system, the "Pneuma-Lectric," is announced by the Keystone Lubricating Co., Philadelphia, Penn. This new system is said to provide automatic operation with intermittent feed adjustable to the requirements of the units being served. After determining the amount of lubricant for the particular machine and how often it requires it, the electric clock, which is part of the "Pneuma-Lectric" system, is adjusted to make electric contact at the intervals decided on. On contact, an electric motor operating a grease distributor starts, and the correct amount of lubricant delivered to the bearing, etc. The clock control can be adjusted to operate at various time intervals.

The makers claim that the system requires no attention except the occasional filling of the grease tanks and it can be easily adapted to machines of all types and designs.

Synchronous Motor Drives for Gyratory Crushers

By W. C. King
Engineer, Electric Machinery Manufacturing Co., Minneapolis, Minn.

COST of power is an important item in the operation of all types of crushers. For this reason, the selection of a highly efficient driving unit for the crusher is necessary for greatest economy in crushing. Not only should the driving unit be as efficient as possible but the intermediate steps in transmitting power from the driving unit to the crusher must be efficient or their use should be eliminated in favor of a direct drive.

Some types of crushers require close speed regulation to insure maximum production and a uniform quality of crushed products. The Symons cone crusher is a crusher of this type, and so designed and operated that the flow of material is timed against gravity producing a greater capacity of usable sizes. The characteristics and advantages of the synchronous motor, including absolutely constant speed and highly economical operation, make it a preferred drive for this type of crusher.

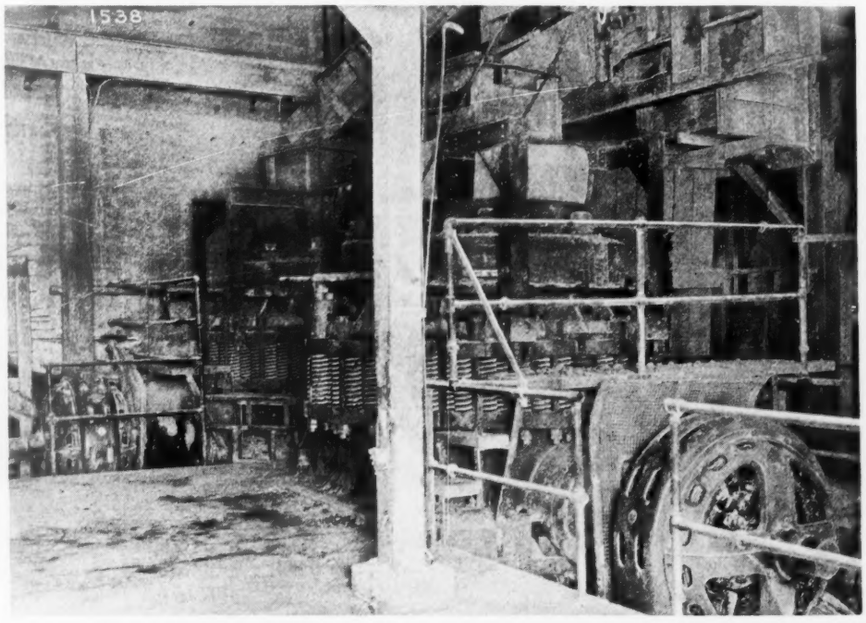
The modern synchronous motor, in most cases especially designed and engineered to its drive, has sufficient starting torque for the majority of industrial applications. On practically all types of crushers, synchronous motors are available with sufficient torque to drive them without difficulty. The high pull-out torque obtainable with the synchronous motor is a desirable characteristic for a motor on crushing duty.

Constant speed is highly desirable for the most successful operation of a crusher of the Symons cone type. In this crusher the number of gyrations of the head per minute regulates the distance the stone will travel between impacts and therefore the size of discharge material. For this reason close speed regulation is very desirable and to realize the fullest advantages the driving motor must be selected to fulfill the constant speed requirement.

Absolutely constant speed regardless of load is obtained in only one type of motor—the synchronous motor. Unlike the induction motor, the synchronous motor has no "slip" and the speed or rotation is constant regardless of variation in load or variation in voltage of the power supply. The synchronous motor rotates in "synchronism" or in "step" with the frequency of the alternating current power system. Use of the synchronous motor, therefore, insures constant speed of the crushing cone—a constant flow of material, and hence a greater capacity and absolute uniformity.

A consideration of power factor is important in any plant using alternating current power. Power factor affects the cost of generation and distribution of electric power. Low power factor is an uneconomical condition for which many power companies penalize. Most power companies now have incorporated in their power rates a preferential rate for maintenance of high plant power factor. Taking advantage of this preferential rate insures the lowest demand and energy charge for electric power.

Synchronous motors always operate at unity power factor, which is the most efficient power factor for the operation of an electrical power system, or a leading power factor to compensate the lagging power factor of induction motors. Induction motors, on the other hand, always operate at lagging power factor and with the motor speeds (450 to 514 r. p. m.) required for direct coupling to the Symons cone crusher, the power factor of an induction motor will be low, especially in part load. The relative power factor of synchronous and induction motor is shown in the curves in Fig. 1. Induction motors operate at a lagging power factor at all loads whereas the synchronous motor delivers, at part load, a leading reactive kv-a. to compensate for the lagging power factor of other equipment of the plant. Synchronous motors are designed for unity or leading power factor, depending on the requirements of the installation. Their use insures material reduction in power cost by maintenance of the high power factor whether power is purchased or privately generated.



Two synchronous motors, 250-hp., 450 r.p.m., driving 7-ft. cone crushers at the St. Louis Smelting and Refining Works of the National Lead Company at St. Francois, Mo. These are the first crushers to be driven by synchronous motors

In the conversion of electrical to mechanical power the synchronous motor operates at a considerably higher efficiency than the induction motor. This is shown in the curves of Fig. 2. At the motor speeds used for the Symons cone crusher, the full load efficiency of the synchronous motor is approximately 3% over that of the induction motor. In addition, the synchronous motor efficiency is high at part loads.

Higher efficiency results in a material saving in power cost. Thus a 250-hp., 450 r. p. m. synchronous motor will have approximately 5 kw. less loss than an induction motor of the same rating. With power at 2c per kw. hr. and 10 hours daily operation,

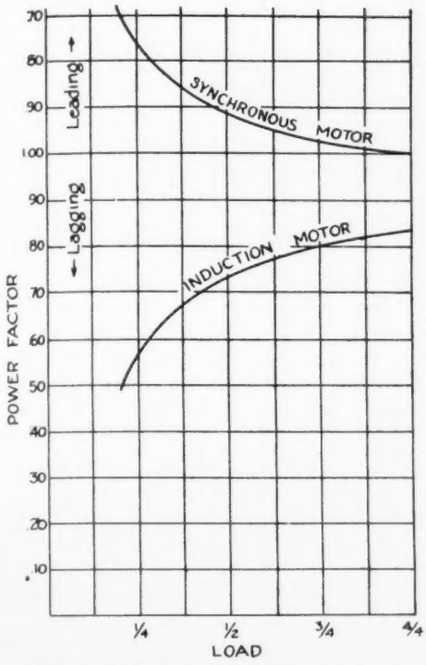


Fig. 1. Relative power factor of synchronous and induction motors

300 days per year the annual power saving amounts to $300.

Where the cost of power is high and where the motor is in operation a large part of the time, as in crusher applications, the savings in power cost can easily equal, during the life of the machine, the original investment of the motor.

Synchronous motors because of their inherent design characteristics, operate very efficiently and are economical in first cost at low speeds. Induction motors, on the other hand, are handicapped in performance below speeds of 600 r. p. m. so that high speed induction motors with speed-reducing devices are often resorted to.

Direct coupling to the crusher is easily accomplished with the synchronous motor and with a large saving over belt, chain or gear drives, both in floor space, in power cost, in maintenance, and in the elimination of posssible shutdowns due to defects in the speed reducing mechanism. The construction of the synchronous motors is simple and rugged, assuring long life from freedom from maintenance expense. They can be installed anywhere in the plant. The synchronous motor has an air gap much larger than that of the induction motor, making for much less bearing maintenance expense. In dusty, gritty air conditions in which the motors are used, this becomes an important consideration.

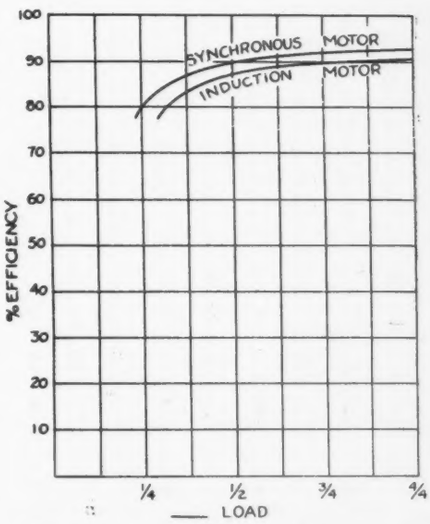
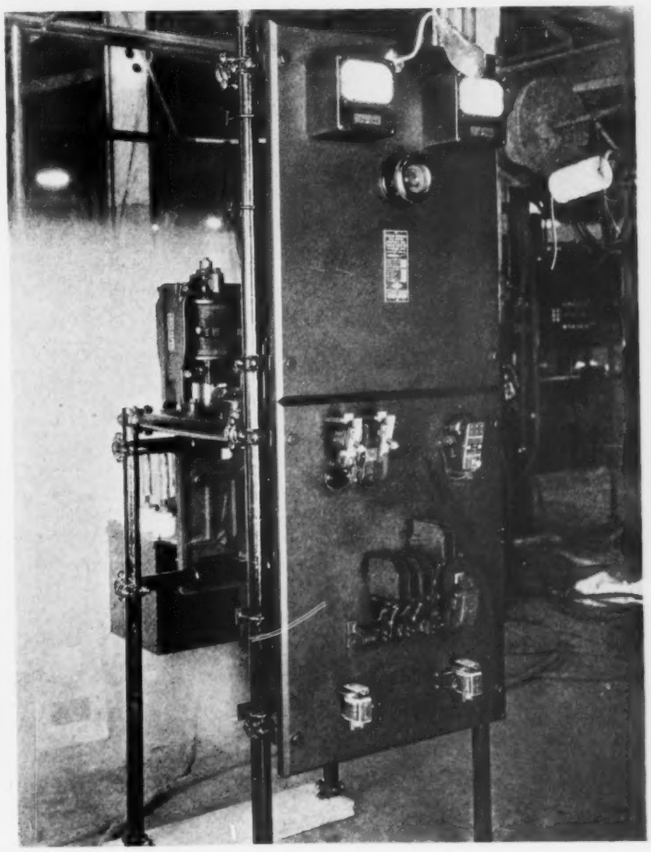


Fig. 2. Comparative efficiencies of synchronous and induction motors at various loads

Modern automatic control for synchronous motors has reduced starting to pushing a start button. The old objections and uncertainties of manual starting of synchronous motors have been entirely overcome in the automatic starter. With automatic starters, the motor is connected to the power line and synchronized to insure starting up

A 7-ft. cone crusher operated by a 250-hp., 450 r.p.m. synchronous motor



A full voltage, oil break, automatic starter for synchronous motors. The controls on this board operate responsive to the electrical condition of the synchronous motor field winding. Full voltage starting is used on cone crusher motors

correctly and in the shortest possible time, and with a minimum disturbance to the power system. Skilled motor attendance is unnecessary and motor starting troubles are eliminated.

In the "field-responsive" automatic type of control, the starting operation is measured and controlled by the currents which are induced by transformer action in the synchronous motor field winding. Fig. 3 shows an oscillogram taken in the field circuit of a synchronous motor and showing the declining rotor frequency as the motor accelerates from standstill to synchronous speed. The rotor frequency is a definite measure of rotor speed and forms an infallible control means for transfering from reduced to full voltage where reduced voltage starters are used and for applying direct current excitation to the field winding for synchronizing or bringing the motors to the field winding for synchronizing or bringing the motor into step.

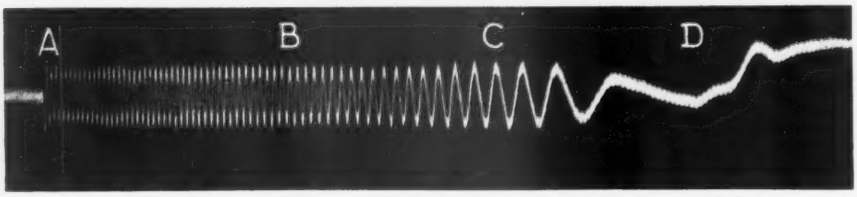


Fig. 3. An oscillogram showing decline of frequency in the rotor circuit of a synchronous motor during the starting period

Referring to Fig. 3, the frequency and motor speeds at points marked are as follows:

Point	Frequency	Motor speed
A	60 cyc.	0
B	36 cyc.	40%
C	6 cyc.	90%
D	3 cyc.	95%

Note: Direct excitation was applied at D pulling motor into synchronism.

One cut shows a typical "field-responsive" automatic starter for synchronous motors. The control equipment is simple and trouble free, and it controls the starting operation to start the motor in minimum time and with the least disturbance on the power system. The field-responsive relay controls the application of the direct current excitation to the field winding. A feature of the field-responsive automatic control is the field "kick-off" provision. This feature is of considerable importance in the use of synchronous motors with the Symons cone crusher.

The Symons crusher is so designed that in the event of tramp iron or other non-crushable material entering the crusher, the heavy springs compress and allow the foreign material to pass through without doing any damage. This, however, throws a heavy load on the driving motor which will probably exceed its pull-out torque. If the field of the synchronous motor is left on, and the motor pulls out of step, the motor will come to a stop. Unless the flow of material is immediately stopped, it will be necessary to clean the crusher out before starting it again. With the field-responsive control, the field excitation is immediately removed if the motor pull-out torque is exceeded. This allows the motor to come up as an induction motor and automatically resynchronize. It therefore becomes unnecessary to stop the flow of material and the crushing operation is not interrupted.

Synchronous motors have in recent years found wide application to all types of crushing equipment including gyratory crushers, hammermill crushers, roll and jaw crushers, and other primary crushers. The scores of synchronous motor driven crushers now in use are ample evidence of the advantages and suitability of synchronous motors for crusher drive.

Mixer Truck for Premix Concrete and Concrete Aggregates

THE "Stepanian" mixer for mixing the aggregates and water in transit or at destination and which can also be used for mixing and transportingg premix concrete has been recently brought out by S. Stepanian, vice-president and general manager of the Arrow Sand and Gravel Co., Columbus, Ohio. The new device comprises a tight drum with short cylinder section with frustrum ends, mounted as a unit on a standard motor truck. This drum is of the self-cleaning, bottom dump type and is equipped with mixing blades. All structure of the unit is placed above the chassis frame, a feature which permits accessibility for adjustment and repairs. No extra motors or hydraulic hoist is needed with the "Mixer."

Power for operation (about 10 hp.) is taken from truck motor by means of a chain, gear or Texrope drive. Quick mixing is said to be assured because of the "figure 8" mixing motion. The mixer, it is claimed, can carry hot concrete for winter construction, and is also adapted for the mixing of building mortar and the transportation of gravel or sand.

Easily applied and detachable water tanks are supplied. These furnish water to the mixer from both conical ends by gravity from above the mixing surface. The open-top loading of aggregates is claimed to eliminate premixing of aggregates before admission to the mixer. It is not necessary to revolve the drum to charge the mixer.

Mixed concrete is discharged from the mixer to a belt conveyor of 2-cu. yd. per min. capacity and adjustable to discharge at different heights. This conveyor can, it is claimed, discharge the concrete to forms or hopper 7 ft. above the ground and located within a 15-ft. radius from the discharge point of the belt. It operates while the truck is in motion and with a long pivoted discharge chute makes a quite useful and flexible means for concrete placing. One lever operates all the mechanism.

Some of the other advantages claimed for the new "Mixer" are: Savings in costs of rehandling aggregates on the job; accurate design and thorough mixing of the concrete mix; delivery and placing of concrete without interruption of traffic in congested districts; great delivery radius and hence increased market area; efficient use of all available volume for material; adaptability to meet different job conditions.

The truck mixer with its conveyor at low angle with swivel discharge chute folded underneath the conveyor, in the position that it would travel on the road

Another view showing the discharge valve open on the mixer drum. The belt conveyor is in low angle position with the discharge chute extended

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Metropolitan Boston's First Ready-Mixed Concrete Plant

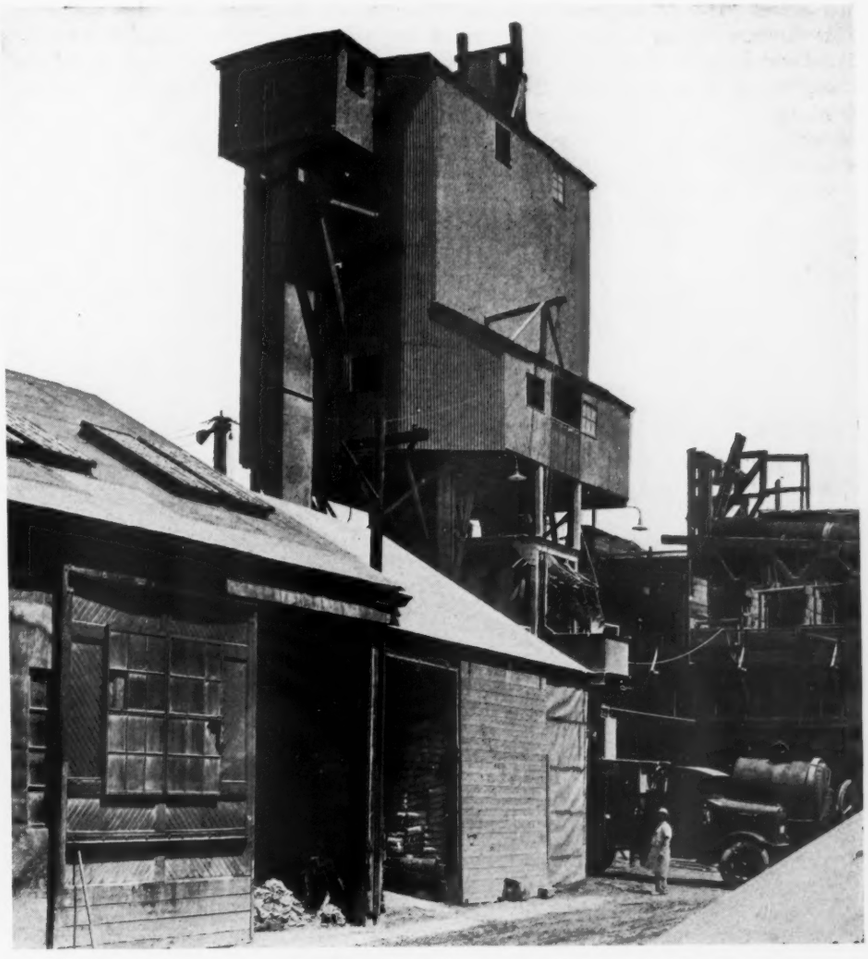
By Miles N. Clair
Vice-President, Thompson & Lichtner Co., Inc.

CENTRAL mixing plants of large size constructed for the manufacture of concrete for a particular project or several projects, have been known for many years. About 1921 the first plant was started in this country to supply concrete to the general public just as steel mills supplied structural steel. Like most new developments there were many problems which had to be studied and solved and much educational work to be done among engineers and architects. During the first five years only a few central mixing plants were started, but recently the number has increased very rapidly and today there are very few large cities that do not have one or more organizations selling concrete either mixed at a central plant or batched at a central plant and mixed in the truck.

Factors Contributing to Success

The first organization formed in Boston to sell ready-mixed concrete started deliveries during the summer of 1928. Two Barrymore trucks which mix in transit or on the job were used. Batching was done at the material supply yards of the controlling organization who were material dealers. The operations of this organization were taken over about January, 1929, by the Boston Sand and Gravel Co. who then formed the Boston Concrete Corp. and proceeded immediately to establish a central batching and mixing plant in one of its Cambridge material supply yards. The first deliveries from that plant were made in May of this year and the product has been so well received that at present the plant, despite day and night operation, is unable to fill all orders. The success of this installation has exceeded the expectations of all parties concerned and is due to a number of factors among which are (1) Advantageous plant location, (2) Affiliation with a material supply organization, (3) Selling through material dealers only, (4) Layout of plant and selection of equipment to eliminate labor and delays and to insure uniform concrete, (5) Careful attention to servicing the jobs or helping the contractor devise means for taking the concrete from the trucks, (6) Careful control of the quality of the concrete by constant testing of the materials and concrete.

The location of the plant puts it within less than a one-hour haul of practically all of metropolitan Boston, the principal market for concrete. Being in the material sup-



Ready-mixed concrete plant operated by the Boston Concrete Corp. to serve metropolitan Boston

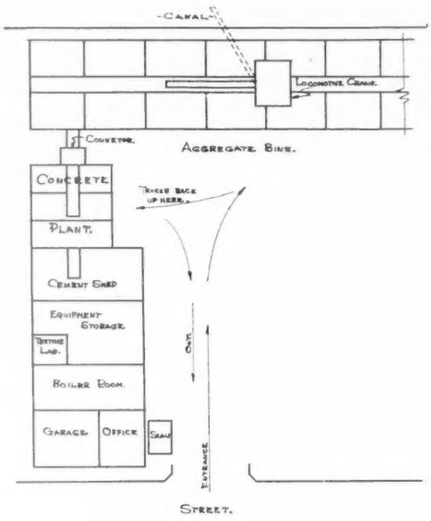
ply yard of the parent organization there is also the great advantage of allowing a certain amount of combination of personnel, office space, and trucks, as well as furnishing an extra reserve to draw upon for aggregates if required.

Aggregates are received by barge and unloaded using a clamshell bucket dumping directly into large bins which supply a bucket conveyor that feeds the plant hoppers. One bucket conveyor handles all the aggregates and is used first for one material and then for another. The clam shell may be used at any time to move material from other bins to those feeding the plant. It is also possible to move material by truck from any bin direct to the conveyor.

Cement is brought in by truck from cars on a nearby siding and put into a storage house adjacent to the plant. The bags are opened here and the cement dumped into a bucket conveyor which feeds a small storage tank above the mixer floor.

All the ingredients of the concrete except the water are measured by weight. A three-compartment 100-ton storage capacity Eric "Aggremeter" is used for the aggregates. There are compartments for sand, 1-in. gravel and 2-in. gravel, respectively. A single beam scale is used for both the sand and gravel. The cement is weighed in a Blaw-Knox weighing batcher. It has been found necessary to install air jets in the chute leading from the bin to the batcher to prevent arching of the cement. Accuracy of weighing is aided by the use of overweight indicator dials on all scales.

Water is measured by volume in a Blaw-Knox tank which fills completely each time. The quantity withdrawn is indicated by the level of the water on a graduated scale on the side of the tank. The accuracy of the measurement depends on how quickly the outlet valve is closed. A weigh batcher for water is being considered to give closer control of this important element of concrete.



Plan of the Boston Concrete Corp.'s Cambridge, Mass., plant

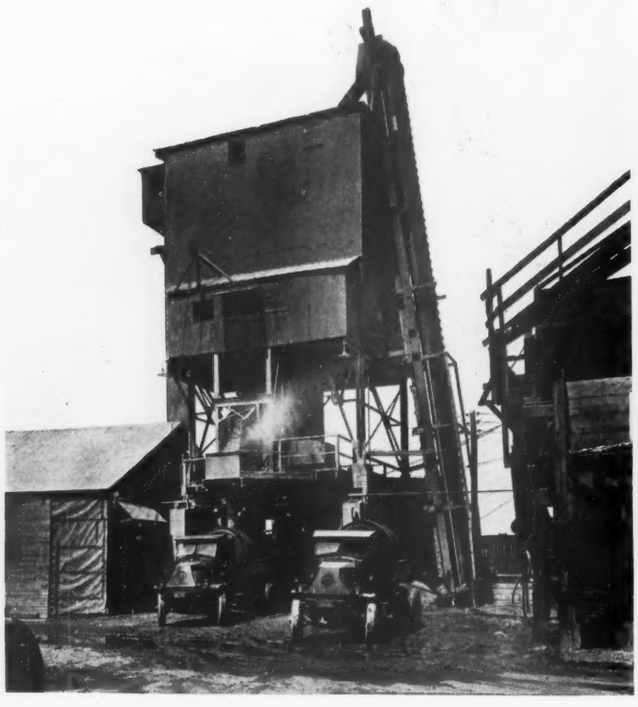
The concrete is mixed in a 2-cu. yd. Lakewood mixer, motor driven, which discharges into a small hopper and chute. The hopper originally was of sufficient size to hold one batch but experience has shown that no real delay occurs if the batch is allowed to flow directly to the truck. The truck then waits until the second batch is mixed and discharged.

There are in operation at present 11 trucks, all of 3-cu. yd. capacity, including five Clinton trucks and six Blaw-Knox agitator trucks. Two Barrymore trucks* also were formerly used. The Clinton truck consists of a closed steel cylinder, mounted on a truck chassis, which can be filled through an opening in the side and discharged through another in the end. The rotation of the cylinder produces a mild mixing action sufficient in general to prevent segregation. The Blaw-Knox agitator truck is an open half-cylinder mounted on a truck chassis with a discharge gate at the end. The concrete is given a small amount of mixing by paddles attached to a longitudinal shaft. The Barrymore trucks are very similar to the Blaw-Knox agitator trucks except that they carry water tanks and are intended to receive the materials and mix them in transit or at the job. The Blaw-Knox agitator truck has an advantage, for this organization, in that it can be used to transport aggregates when there are not sufficient orders for concrete.

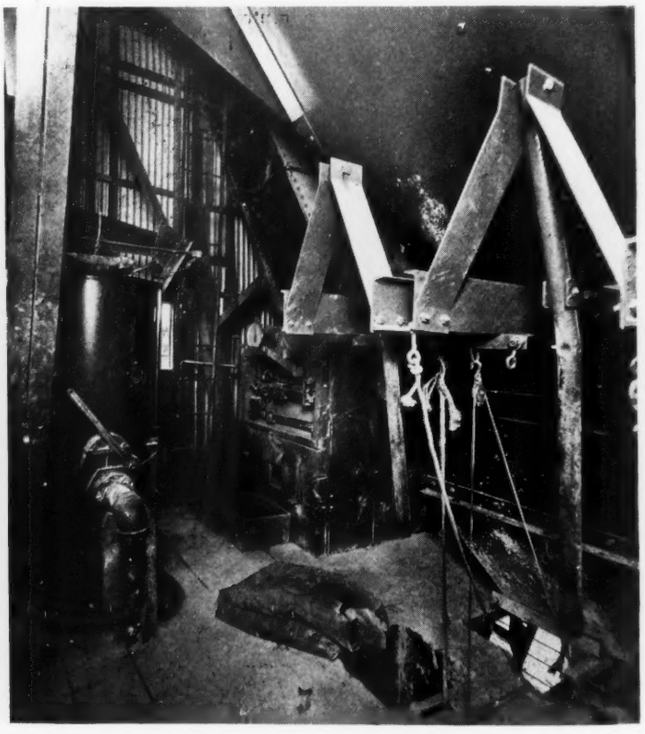
Small Operating Force

The operating force of the Boston Concrete Corp. is as small as experience has shown can efficiently carry on the work. It consists of a plant manager, shipper, dispatcher, yardmaster, plant operator, and as-

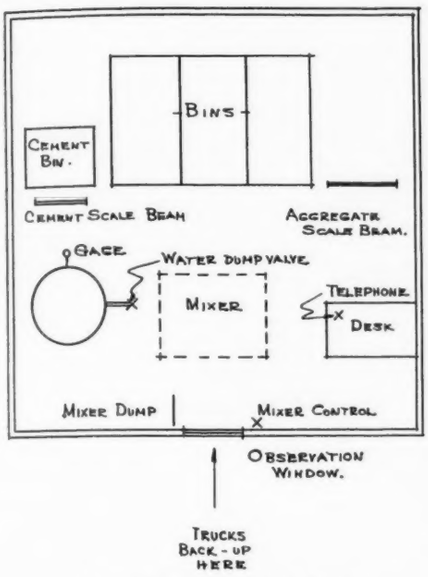
* The plant is so arranged that materials can be by-passed direct into the trucks from the weighing batchers without passing through the mixer.



Aggregates are elevated to the mixing plant



Part of the batching floor



Plan of the operating floor

sistant, a relief plant operator, three laborers for handling cement, truck drivers, and two cleanup men. The plant manager gives about half of his time to going from job to job to see that everything is being done to facilitate the delivery of concrete and the prompt discharge of the trucks. The remainder of his time is given to arranging deliveries for special projects and making control tests of the materials and concrete.

Filling and Shipping Orders

The shipper receives the orders and records them on a special form. He schedules the orders to meet as far as possible the requirements of the customer and the capacity of the plant. If the arrangement is acceptable to the purchaser the order is entered, otherwise it is immediately rejected. The plant operator receives a copy of the schedule, for the day, in the morning and is informed by telephone by the shipper as to the mix, number of yards and rate of shipment as changes in orders occur during the day. The plant operator proportions and mixes the batch and also in many cases decides which of the trucks available in the yard shall take the next batch. The usual procedure, however, is for the shipper to assign at the start of the delivery a certain number of trucks to a given project and to keep them on that project until completed. A larger or smaller number of trucks are used in accordance with the rate at which concrete is required on the job.

When the truck driver has received the load of concrete, which is usually three yards, he drives to the dispatcher's window and there receives two copies of the driver's ticket properly filled out. The original copy is kept by the dispatcher, one carbon is kept by the customer and the other carbon is signed and returned as a receipt of delivery. The truck driver also receives a delivery record slip which is stamped with the time the truck leaves the yard and when it returns. On the job the other items must be filled in and where the time on the job exceeds 15 minutes, the foreman in charge signs the slip and it is the basis for an extra charge for delay. If the concrete is to be delivered within the jurisdiction of the Boston Building Department, the truck driver is given a form properly filled out which he hands to the city inspector on the job.

Truck Maintenance

The maintenance of the trucks is under the direction of the yardmaster, who gives the drivers instructions in regard to their care and operation. The truck bodies are washed at the end of the day, when changing from hauling concrete to hauling aggregates or the reverse and when a long delay occurs between loads. All trucks are garaged when through for the day and carefully gone over to detect defects which may cause breakdowns. The plant machinery, buildings and yard are kept clean and in good working condition by two "cleanup" men, who start work at 4 p. m. and continue until midnight or longer. These men see that the material bins are full and in general that the plant is ready for operation the next day.

DRIVER'S TICKET

BOSTON CONCRETE CORPORATION
118 FIRST ST. CAMBRIDGE

Date_____ 19___

Sold to_____

Delivered to_____

Address_____

Time Left_____

CONCRETE C. Y. MIX

ADMIXTURE

Driver_____ Truck # _____

Shipper

Received by_____

PLEASE SIGN AND RETURN

100217

The driver's ticket is in triplicate. One copy is kept by the dispatcher, the second by the customer and the third signed and returned as a receipt

The production of concrete of uniform high quality is the aim of the Boston Concrete Corp. and to attain this end a plan of quality control was immediately put into effect at the start of operations.

Quality Control Plan

The essential features of the plan are (1) the operation of the plant by an experienced concrete foreman who can be relied upon to properly make minor changes in the mix as conditions change; (2) careful control of the total water content; (3) tests of aggregates and adjustment of mix on the basis of these tests to give the desired proportions on a volume basis and the desired quantity per batch; (4) tests of the concrete as poured on the job to give a check on the strength; (5) miscellaneous investigations

BOSTON CONCRETE CORPORATION
118 FIRST ST. - CAMBRIDGE, MASS.

Date .....

We have at (..... A. M.) today
(..... P. M.)

delivered to No. ..... Street

..... District

..... yards of ready mixed concrete.

Cement Sand Stone

Proportions .....

No. of bags of cement used .....

Brand of cement used .....

No. of cubic feet of stone used .....

Size of stone used .....

No. of cubic feet of sand used .....

BOSTON CONCRETE CORPORATION

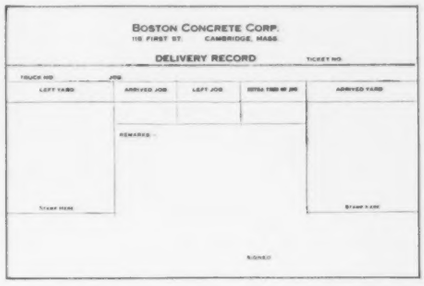
Per .....

Form used for deliveries made to the city building department

to give information of value in improving the product.

Fortunately, an extensive investigation of the aggregates to be used, had been completed in 1928. The data covered many determinations over a period of more than a year of the grading, voids, weights per cubic foot dry and loose, damp and loose and dry and rodded, specific gravity, moisture content under certain conditions, organic and silt content. Concrete tests covering a wide range of mixes and combinations of materials for ages up to one year also formed a part of the investigation. This data gave an excellent basis for the preliminary computations.

It was expected that the concrete would be sold largely on the basis of volume proportions and a definite quantity per load. Tables of quantities were therefore prepared for the weights of material and volume of water for aggregates in dry, average damp


BOSTON CONCRETE CORP.
118 FIRST ST. CAMBRIDGE, MASS.
DELIVERY RECORD
TICKET NO.
TRUCK NO. JOB
LEFT YARD | ARRIVED JOB | LEFT JOB | ARRIVED YARD
REMARKS:
STAMP HERE
STAMP HERE
SIGNED

The delivery record is stamped with the time the load leaves the yard and again on return

and very damp conditions to produce one cubic yard of concrete of desired consistency for specifications (a) with mix unlimited, strength specified, (b) nominal mixes such as 1:2:4, (c) mixes in accordance with the Boston Building Code which specified strength and proportion by volume of cement to total volume of aggregates measured separately. These quantities are used as the basis of all measurements in the ordinary plant operation, tests having shown that the strengths obtained average well above the requirements, that the quantity produced checks closely the compueted volumes, and that the workability of the concrete is good.

A plant testing laboratory is located in the equipment storehouse close to the plant office. The tests of aggregates are made here by the plant manager or under his direction. The routine tests consist of a determination of the moisture in the aggregate three times per day usually at the start in the morning, 11 a. m., and 3 p. m., additional tests being made when moisture conditions change quickly for any reason. Samples of the aggregate are also taken at the same time and the per cent. of voids determined. This data is used to make adjustments in the tabulated proportions and water content as determined upon by the plant manager. In addition to the above routine tests, several times a week a complete mechanical analysis is made of samples of the aggregate. Specimens are taken at regular intervals (generally two sets a week) from the concrete on the job either by the plant manager or by a representative of a local testing laboratory. Copies of these tests are given to the City Building Department and the customer when requested.

There are always minor variations in the materials which effect the characteristics of the concrete from batch to batch. In order to eliminate this variation as much as possible the plant operator, an experienced concrete foreman, is allowed to make changes in the batch in accordance with a definite schedule to take care of (a) variations in grading of aggregates, (b) variations in moisture content. Definite instructions are also given for changes to be made, in the absence of the plant manager, in the proportions to give desired changes in consistency or slump.

The total mixing time is limited to a minimum of 1½ min. for a 1½ cu. yd. batch. The cycle consisting of weighing the sand, gravel, and cement in the order given, during the mixing of the previous batch, dumping that batch and then charging the sand and gravel followed by the cement and water. Investigation has been made of the effect of the time of transportation on the strength of the concrete. Specimens were made at intervals from the concrete of two trucks with the results as shown below:

Blaw-Knox agitator truck (approx.) 1½ r.p.m.).
Mix—1:2:4 by dry and loose volumes.
W/c=0.95.
Weather—Cloudy and cool.
Average temperature—66 deg. F.
Maximum temperature—67 deg. F.
Minimum temperature—65 deg. F.
Average relative humidity—85%.
Maximum relative humidity—92%.
Minimum relative humidity—82%.

Time of mixing	Slump, inches	Compressive strength, lb./in.² 7 days	28 days
0.33 hour	7.75	2400	3050
	7.50	2050	3300
	7.62	2225	3175
1.00	7.00	2550	3400
	6.75	2400	3650
	6.87	2475	3525
1.50	7.00	2650	3500
	6.50	2800	3750
	6.75	2725	3625
2.92	4.00	2750	3650
	3.75	2750	3800
	3.87	2750	3725
3.58	2.50	2450	3150
	2.25	2750	3300
	2.37	2600	3225

Clinton rotating body truck (approx. 4½ r.p.m.).
Mix—1:2:4 by dry and loose volumes.
W/c = 0.95.
Weather—Cloudy and cool.
Average temperature—66 deg. F.
Maximum temperature—67 deg. F.
Minimum temperature—65 deg. F.
Average relative humidity—85%.
Maximum relative humidity—92%.
Minimum relative humidity—82%.

Time of mixing	Slump, inches	Compressive strength, lb./in.² 7 days	28 days
0.50 hour	7.25	2450	3150
	7.00	2450	2850
	7.12	2450	3000
1.08	7.00	2550	3300
	6.75	2750	3400
	6.87	2600	3350
1.67	6.50	2800	3550
	6.00	2650	3750
	6.25	2725	3650
3.00	2.00	2950	3700
	1.00	2800	3900
	1.50	2875	3800

The average length of haul is 25 minutes and the maximum about an hour. Further investigation of this and other factors are contemplated or in progress.

Winter operation has been given serious study and plans decided on are being completed. The plans include (a) complete enclosure of the plant, (b) heating of aggregates by steam jets in bins, (c) the use of hot water, (d) possible covering of open top trucks with canvas covers.

The Boston Concrete Corp. sells its product only through certain material dealers of which there are now seven in number. These dealers receive a commission of about 75 cents per yard. The schedule gives an idea of the range of prices. When admixtures are requested the prices are increased either 100% or on the basis of the cost of the admixture plus 25% increase in list price for handling. An extra charge is made of $1 per cu. yd. for every 15 minutes' delay beyond the first 15 minutes on the job. Credit is given at the same rate for delay to the job due to slow delivery after pouring has started. These changes generally balance each other.

The plant manager is D. D. Reynolds, with the Thompson and Lichtner Co., Inc., of Boston, retained as consulting engineers to advise on operation, quality control, and investigations.

BOSTON CONCRETE CORPORATION
118 FIRST STREET, CAMBRIDGE, MASS.
READY-MIXED CONCRETE

SCHEDULE OF PRICES
1:2:4 MIX — BASE PRICE PER C. Y.

Quantity	Price	Discount*	Net Price
3 to 50 yds.	$10.00	.50	$9.50
50 to 250 yds.	8.75	.50	8.25
250 yds. and over	8.25	.50	7.75

MIXES OTHER THAN 1:2:4

1:3:6	Deduct	$.50 per c. y.
1:2½:5	Deduct	.25 " "
1:2:3	Add	.45 " "
1:1½:3	Add	.55 " "
1:1:2	Add	1.30 " "
1:2	Add	3.00 " "

SMALL LOADS
2 c. y. load add $2.00 per c. y.
1 " " add 4.00 " "

*Discount allowed on deliveries made between the 1st and the 15th of the month if bill is paid on or before the 25th and on deliveries made between 15th and 30th if paid on or before the 10th of the following month.

Anyone using more than 250 cubic yards in the calendar year will be credited on the first 250 yards down to the net price of $7.75.

Orders for READY-MIXED CONCRETE *will be filled by*
BOSTON SAND & GRAVEL CO., Phone HANcock 5520
W. C. NORCROSS CO. " HANcock 6930
WM. S. SIMPSON, INC. " HANcock 7150
C. H. SPRING CO. " WELlesley 0200
WALDO BROTHERS CO " HIGhlands 3000

July 15, 1929

Schedule of prices for ready-mixed concrete made by the Boston Concrete Corp.

Newark Gravel Plant Opened

OPERATIONS have been started at the Newark Sand and Gravel Co., a new company headed by H. E. Noelp of Columbus, president and treasurer, and J. R. Speck, Newark, secretary and manager.

The Newark, Ohio, plant is capable of furnishing 250 tons per day and was constructed at a cost of approximately $16,000.

The company deposit near Raccoon creek has been prospected to the 47 ft. depth and a large supply of bank material is in sight. In addition to the usual washing and screening equipment, a 400-ton storage bin has been erected.—*Newark* (Ohio) *Advocate.*

Atlas Rock Making New Rail Connections

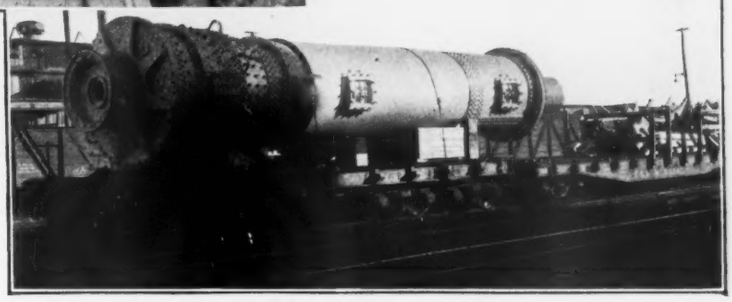
PERMISSION has been granted the Atlas Rock Co., Oakland, Calif., to build about four miles of railroad, part of which will cut across certain Oakdale streets in order to connect up with the Southern Pacific line running through the city, according to C. C. Newkirk, general manager of the company. Construction will begin at once.

About $17,000 has been spent by the Atlas company this summer in renovating and improving the plant, Mr. Newkirk stated, and, also, that approximately $10,000 more would be spent on the plant in the near future. The concern this summer purchased new deposits across the river from the plant.

The company plans operating on a more extensive scale as soon as the road is built. —*Oakdale* (Calif.) *Leader.*

These views show the shipping and installation of the No. 8740 Compeb Mills for the Republic Portland Cement Company's new plant near San Antonio, Texas. The lower view shows one of the mills loaded on a special Ailis-Chalmers car for shipment, the others show the placing of the mill in the bearings.

Compeb Mills



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News of All the Industry

Incorporations

Mineola Concrete Co., Mineola, N. Y., $25,000.

Hill Sand and Gravel Co., Ltd., New Westminster, B. C., $100,000.

Steven Parelli and Son Co., Inc., Trenton, N. J., $100,000. Amos M. Wain, Trenton. To produce limestone, etc.

Staunton Lime Co., Inc., Staunton, Va., $50,000. To quarry, mine and manufacture stone, limestone and other minerals. Robert L. James, president.

Newcomb Concrete Process Co., Denver, Colo., 100,000 shares no par value. Edward J. Brown, Richard L. Newcomb and Ethel M. Newcomb.

Del Rio Stone Co., Houston, Tex., increasing capital from $100,000 to $300,000. Albert Schrader, president, Marine Bank Bldg., Houston.

Houston Concrete Pipe Co., Houston, Tex., $20,000. S. H. Walker and C. L. Kerr, 3416 Audubon Place, Houston.

Mortar Supplies Co., Chicago, Ill. (2100 Balmoral Ave.); 1000 shares no par value. To manufacture cement, mortar, plaster, etc. John and Mrs. John Reinberg and Edw. N. Miller.

Choctaw Clay Corp., Canal Bank Bldg., New Orleans, La., 150,000 shares no par value common stock. To develop fuller's earth deposits. R. J. Wilkinson, president.

Tri-State Sand and Gravel Corp., Angola, Ind., 1000 shares, par value $10. To produce sand, gravel, stone, etc. F. E. Thomas, Claudia F. Thomas and Cortland S. Willard.

Indiana Stone Corp., Indianapolis, Ind., 500 shares preferred and 500 shares common, no par value. To produce and deal in limestone and similar products. Frederick E. Schortemeier, Robert E. Eby and Joseph G. Wood.

Quarries

Valhalla, N. Y. The old Kensico quarry on the Kensico road northeast of Valhalla has been purchased by Nathan Straus Jr. of New York City, chairman of the Park Commission, who will convert its 12 acres into a private fish and game preserve.

Cleveland Stone Co.'s subsidiary, Sterling Grinding Wheel Co., Tiffin, Ohio, has under way an expansion program involving an expenditure of more than $100,000. Work is in progress on a one-story building to provide 18,000 sq. ft. of floor space, and is to be followed next spring by the construction of another building of equal size.

Texas Quarries, Inc., Austin, Tex., has awarded contract to the International Steel and Iron Co., Evansville, Ind., for the first unit of its stone fabricating mill, between E. 19th St. and Austin-Houston Highway, Llano, Tex. The building is to be one-story, all-steel, 265x128 ft. Bedford Foundry and Machine Co., Bedford, Ind., will furnish two 7½-ton motor-driven electric traveling cranes and a 25-ton crane. The total cost, including equipment, is estimated at $250,000. Rex E. St. John, Scarborough Bldg., Austin, Tex., is manager.

Harleston and Womack, Kentwood, La., have signed a contract with R. L. Gant for sandstone deposits on 200 acres of his property five miles north of Crystal Springs, Miss. Work has already begun on a spur line, more than a mile in length, connecting the sandstone mine with the main line of the Illinois Central railroad. The company has a contract with the United States government to furnish 200,000 tons of sandstone to complete a large engineering project in Louisiana, and to start with will employ 75 people at the mine.

Sand and Gravel

R. W. Baird of the Home Builders store at Carlsbad, Calif., has taken over the sand business, equipment and lease on the Santa Margarita sand pit from R. G. Chase of this city.

Hill Sand and Gravel Co., Ltd., New Westminster, B. C., has installed a 300-ft. automatic belt conveyor at its new operation to speed up deliveries from the pit to the separating plant. A large tractor, in place of the present small tractor and team, will be used to remove material from the pit, which extends for 100 ft. A 300-ft. channel will be dug out first to a depth of about 50 ft., thus giving a long cliff of the deposit to work from. The plant has a capacity of 150 yd. a day.

Cement

Alpha Portland Cement Co., Easton, Penn., has resumed operations at its Manheim, W. Va., plant, according to W. L. Matthes, superintendent.

Colorado Portland Cement Co.'s plant at Ft. Collins, Colo., according to newspaper reports, will be closed temporarily because of the discontinuance of the commercial gas supply furnished by the Colorado and Wyoming Gas Co. from Wellington and Fort Collins fields. Production will be resumed soon, either by using gas piped from Amarillo, Tex., or by using coal. The plant was recently visited by the Colorado section of the American Chemical Society.

Louisiana Portland Cement Co., New Orleans, La., entertained the Jackson (Ala.) Lions Club on an inspection trip to its crushing plant at Old St. Stephens recently. The trip to the plant was made on the company's launch, "The Laport," and the party returned on the new all-steel deisel-powered towboat "Incor," which the company put in service between the rock plant at St. Stephens and the New Orleans factory. Refreshments were served and Frank Morris, superintendent of the crushing plant, was host to the visitors.

Lime

Oliver King Sand and Lime Co., Knoxville, Tenn., has been awarded contract to furnish the city's supply of lime for the fiscal year.

C. E. Schildknecht, Frederick, Md., has acquired the O. J. Keller Lime Co.'s plant at Buckeystown, Md., including 140 acres, building and kiln equipment.

Central Lime and Cement Co., 228 N. La Salle St., Chicago, has acquired a 7-acre tract on 95th St., formerly the property of the American Brake Shoe and Foundry Co., and will establish a storage and distributing plant, to cost more than $100,000 with equipment.

Agricultural Limestone

F. L. Belzer, Osage, Iowa, will supply 1000 tons of agricultural limestone to Mitchell county (Iowa) farmers this fall.

Cement Products

Art Stone Co., Millers Falls, Mass., is to move to Wells St., Greenfield, Mass. The business has been located at Millers Falls for the past 22 years and at present employs about 70 men.

George B. Franklin of Florida is planning the erection and operation of a plant for the manufacture of a new weather-proof wall stucco at Nampa, Idaho. It is expected that 25 men will be employed.

Shelton Concrete Co., Shelton, Wash., has received another large order for the second unit of the power job at Potlatch for nearly 300 tons of 18- and 24-in. concrete pipe. Upwards of 960 sacks of cement and 4500 cu. ft. of sand and gravel will be used in the manufacture of the pipe.

Houston Concrete Pipe Co., Houston, Tex., incorporation notice of which appears in this issue, has acquired a site on Hutton, Lee and Pannell Sts., Houston, and will erect a plant at a cost of $40,000 to produce 50 tons of concrete sewer pipe daily. S. H. Walker and C. L. Kerr, 3416 Audubon Place, Houston, are associated in the enterprise.

Concrete Building Units Corp., Minneapolis, Minn., has been organized to manufacture light-weight building units from cinders and cement, patent rights for which have been secured from the National Concrete Building Units Corp. of Philadelphia. Officers of the new company are: Richard A. Peterson, president; E. O. Johnson, vice-president; R. A. Anderson, treasurer, and W. W. Gibson, secretary. Offices are at 512 New York Life Bldg. and the factory is located at 2500 Washington St., N.E., Minneapolis.

Miscellaneous Rock Products

Southern Amiesite Asphalt Co.'s new plant at Fourth Ave. and 34th St., North, Birmingham, Ala., was recently placed in operation. E. G. Pascoe is manager.

Shale Products Co., Johnson City, Tenn., it is reported, will be the holding company for a number of firms producing building materials in East Tennessee.

Johns-Manville Corp., New York City, producers of asbestos, etc., has taken a number of options covering small sections of land between two large parcels which the company has owned for some time at Asbestos, Que.

Palestine Potash Corp., London, England, has been organized to develop Dead Sea mineral resources. The Earl of Lytton is chairman and there are five British and four American directors, the last including Israel B. Brodie of the International Finance Corp., New York City; E. Friedman, New York manufacturer; B. Flexner, lawyer, and F. M. Warburg, banker.

Choctaw Clay Corp., Canal Bank Bldg., New Orleans, La., is planning further development of fuller's earth deposits in Choctaw county, Ala., adjacent to the main line of the Alabama, Tennessee and Northern railroad. Plant is located a few miles from Meridian, Miss. Officers of the company are R. J. Wilkinson, president; D. B. Williams and John P. Wilkinson, vice-presidents; L. M. Dalgern, secretary and treasurer.

Personals

W. G. Banks, Fort Collins, Colo., chief chemist of the Colorado Portland Cement Co., addressed the Colorado section of the American Chemical Society at its annual meeting at the State Agricultural College, Fort Collins, Colo., on October 26. The subject was "Cement Manufacturing."

O. E. Thaleg

O. E. Thaleg has joined the sales organization of the Traylor Engineering and Manufacturing Co. as a sales engineer at the company's Chicago office. Mr. Thaleg has been associated with the sale and design of crushing plants and machinery for the past 20 years. In the past he has been connected with the Power and Mining Machinery Co., and the Austin Manufacturing Co.

F. H. Winkley has been appointed manager of the consolidated lighting and cable division of the central station department of the General Electric Co., Schenectady, N. Y., following the retirement of Wallace S. Clark, former manager of the cable division, who will now act in a consulting capacity. The lighting and cable division will consist of two sections, the lighting section with **W. H. Robinson**, Jr. as manager of sales, and the cable secton with **R. G. Bellazza** as sales manager.

Obituaries

C. H. Wright, formerly construction engineer for the Kanawha Sand and Gravel Co., Parkersburg, W. Va., passed away at the age of 57.

William E. Miner, for 30 years an officer of the Atlas Portland Cement Co., New York City, and for the last four years one of its vice-presidents, died October 7 at his home at Shippan Point after a week's illness of heart disease.

William Burt Greenman, vice-president of the Brooklyn Builders' Supply Co., and Greenman-Maguire, Inc., and president and treasurer of the Hampton Building Co., Brooklyn, N. Y., died October 25, at the age of 61.

Manufacturers

Republic Iron and Steel Co., Youngstown, Ohio, has acquired the Union Drawn Steel Co., Beaver Falls, Penn.

Cutler-Hammer, Inc., Milwaukee, Wis., has moved its St. Louis district sales office from 611 Olive St. to 1914 Washington Ave., St. Louis, Mo. A warehouse has also been established in St. Louis at the same address.

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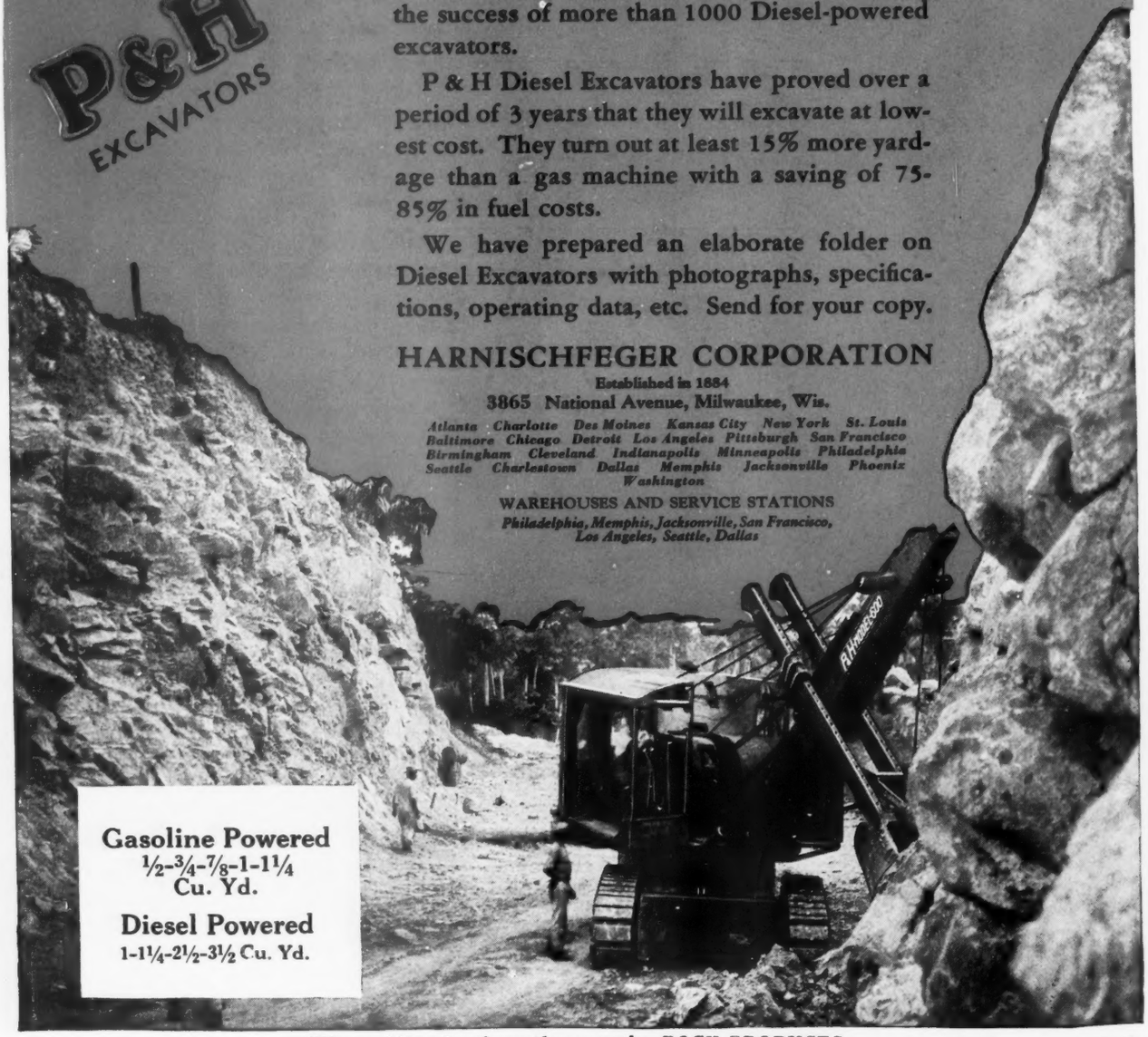

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